AIR CONDITIONING HEATING AND VENTILATING

FEBRUARY 1960

For the Engineer
Engaged in DESIGN
APPLICATION
ESTIMATING
SPECIFICATION
and LAYOUT

As an aid to product quality, each die grinder of Magnetic Metals Company, Camden, N. J., has a separate soundproof room with individually controlled air conditioning. See page 4.

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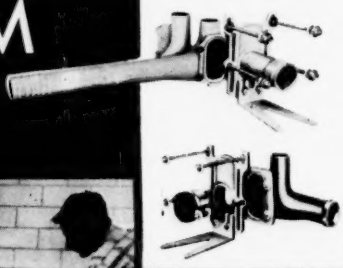
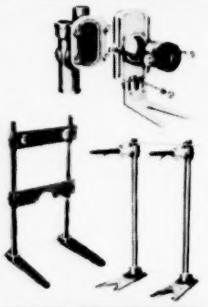
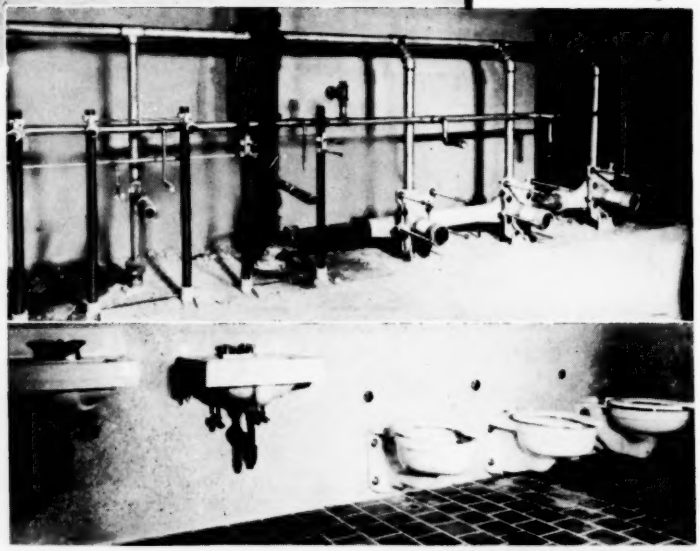
a CLEAN---REST ROOM is up to YOU!---



WALL-HUNG FIXTURE CARRIERS



for a CLEAN SANITARY easy to maintain REST ROOM



SPECIFY SMITH

FOR almost **EVERYTHING**
but the piping and fixtures

The key to maintaining a Clean . . . Sanitary . . . Public Rest Room . . . starts with the man who specifies or installs the plumbing.

Smith Engineered Plumbing Products make it "Plumb-Easy" to Install and Maintain a Modern, attractive, sanitary Public Rest Room in any new or existing building.

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For neat appearance in concealing valves, and providing easy access to supply and drainage piping, Smith Access Boxes and Cleanouts meet the requirements of every installation; and to control the pressures of Hydrostatic shock and prevent Water Hammer . . . Smith Hydro-Trols should be installed on every hot or cold water line.

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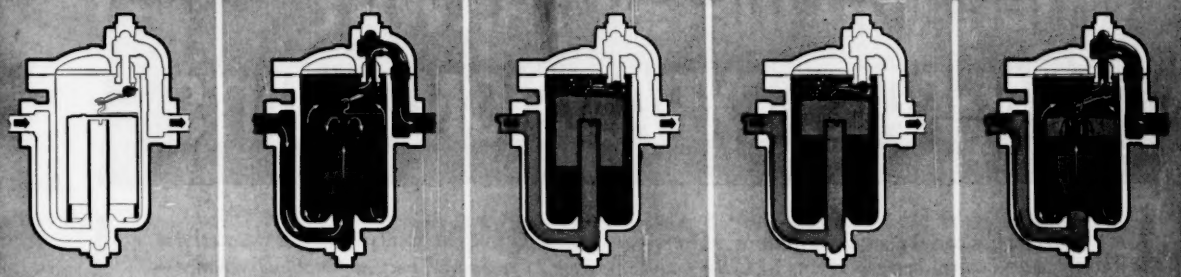
PLUMB-EASY

This simple trap operating principle provides the efficiency, dependability and freedom from maintenance necessary for the most profitable use of steam



When trap is first installed, the inverted bucket is down and the valve is wide open.

When steam is turned on, condensate (solid color) flows into trap and out through discharge orifice, until —

Steam (light color) reaching the trap floats the inverted bucket and closes the valve.

When more condensate enters the trap, the bucket loses buoyancy and pulls on valve lever.

When weight of bucket times leverage overcomes pressure on valve, bucket sinks and opens trap.

Key: condensate steam steam bubbles air bubbles

ARMSTRONG INVERTED BUCKET STEAM TRAPS

are designed and made to give you these big benefits:

● Amstrong Traps, the first inverted bucket steam traps, now represent the most advanced development of this time-proven principle. They provide all the advantages necessary for efficient, economical condensate drainage from virtually all types of steam using equipment.

1. *No steam loss* – Steam never reaches the orifice even when there is no condensate load.
2. *Automatic air elimination* – Vent in trap bucket passes air and other non-condensibles through to be discharged with condensate.
3. *No cooling leg required* – Condensate is discharged at steam temperature as fast as it reaches the trap because trap operates on difference in density between steam and water not on temperature.
4. *Operates on any back pressure* – Failure of one trap in system will not cause others to open because high back pressure does not affect an Armstrong trap other than to reduce capacity. As long as there is a pressure differential across the orifice the trap will close on steam and open for condensate.
5. *Unaffected by ordinary dirt* – Swirling action of condensate keeps dirt in suspension until discharged with condensate, prevents it from lodging in valve.
6. *Completely dependable* – Proved design plus the use of all stainless steel working parts assure continuity of service and length of service unmatched by any other trap.
7. *Big capacity in a small, economical package* – Armstrong design gives you the highest practical capacity for any given pressure. And remember, Armstrong capacity ratings are based on *hot* condensate at the *working pressure differential* stated, not on theoretical orifice capacities.

Further information on these advantages plus much additional information is given in the 48 page Armstrong Steam Trap Book. Ask your local Armstrong Representative or write direct.

860 Series for low pressure heating service.

800 Series, side inlet, side outlet.

No. 801, side inlet, bottom outlet.

880 Series, integral strainer.

200 Series, bottom inlet, top outlet.

Forged Steel Series for high pressures, high temperatures.

The 48 page Armstrong Steam Trap Book tells how to correctly size, install and maintain steam traps for any pressure, any temperature, any load plus full catalog data on Armstrong Steam Traps. Ask for Catalog K.

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Why do industrial plants, institutions, universities and central heating plants SPECIFY and INSTALL Yarway Gun-Pakt Expansion Joints?

Because with Yarway you get:

- **CONTINUOUS SERVICE**
  Costly shutdowns are eliminated. Packing is seldom necessary but may be added *under full line pressure.* No vents are necessary. Never needs repacking.
- **RUGGED DEPENDABILITY ALL STEEL CONSTRUCTION**
  Durable chromium plated seamless steel sleeves. No chance *of metal fatigue.* Wrought steel bases provide rugged, positive anchorage.
- **INTERNAL AND EXTERNAL GUIDES**
  Positive alignment of sleeve in stuffing box *—where it counts!*
- **LIGHT WEIGHT, STREAMLINED DESIGN**
  Requires less space to install—less space to maintain—smaller manholes.

Many Gun-Pakt joints have been *in service over 25 years with only nominal maintenance*—no major repairs or periodic overhauls. Maintenance costs are negligible—records show average to be one manhour and 65 cents worth of packing per joint per year. AND—NEVER A SHUTDOWN FOR REPACKING!

YARWAY field engineers are qualified to advise on installation and service—at no cost to you. Investigate today. Write for Bulletin EJ 1917 ('59).

FOR YOUR NEXT PIPELINE JOB—BE SAFE—BE SURE! SPECIFY YARWAY GUN-PAKT.

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104 Mermaid Avenue, Philadelphia 18, Pa.
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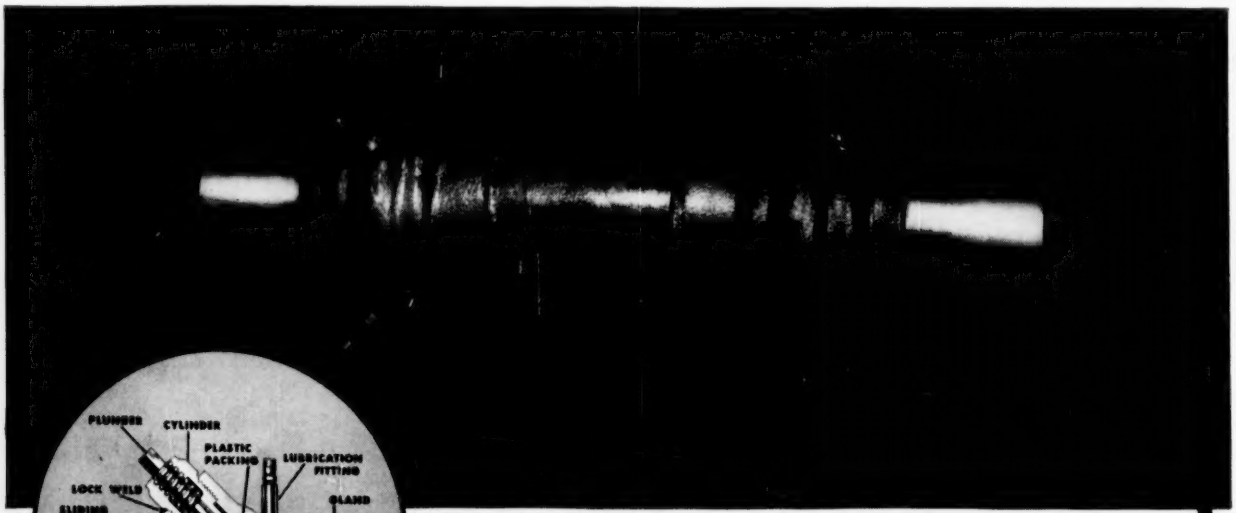

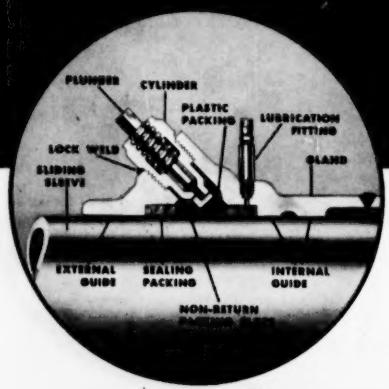

Cross-section of Gun-Pakt feature. To add packing, just insert a plug and turn the plunger. Note non-return packing slots.

YARWAY GUN-PAKT

AIR CONDITIONING HEATING AND VENTILATING

Volume 57, Number 2 **February, 1960**

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This month's cover photo: Craftsman at work in his own private quarters at Magnetic Metals Company plant, Camden, N. J. Each shop office has individually controlled air conditioning, complete sound-proofing. Object—to attract and hold skilled die makers and grinders. Soundproofing enables the grinders to better hear the "kiss" of the grinding wheel as it contacts tungsten carbide precision dies, often machined to tolerances of 0.00005 inch.

HIGH SPOTS

A four-barreled blast at resistance to electric resistance heating was delivered to over 200 attendees at the January 7 meeting of the Northern New Jersey Chapter of ASHRAE by three utility representatives and a consulting engineer, Clifford W. Zimmer, of Morrison and Zimmer, Union, N. J. They called for, at the very least, a general recognition that electric heating has a place in residential and commercial buildings that are designed for it, plus a reasonable consideration of electric heating in future plans.

The argument, in a nutshell, was that electric heating, as compared with other systems, provides not only lower installation costs but also lower overall costs when "properly engineered". This was elaborated to mean: (1) installation of reliable controls, and (2) application of insulation in 2-inch increments to an economic point of 6% return on insulation investment.

Those who anticipated negative reaction from the audience were not disappointed. Rebuttal took many forms, from "Let's stop all this hogwash about installed costs and amortized savings and talk about delivered cost of energy" and "Let's do better engineering on our 'wet heat' jobs to lower installation costs" to a not-original but constructive suggestion that the utilities look into the electric heating of stored water at night electric rates to be used for day-time space heating.

The recent past has witnessed a rash of mergers in the heating and air conditioning industry. Three of them are reported in this issue: purchase of National-U.S. Radiator by Crane, of Colorado Research by Bell & Gossett, and Buensod-Stacey by Aeronica. For details, see Briefly Stated department, pages 136 and 138.

A new trade organization, the Industrial Gas Cleaning Institute, Inc., has been formed by representatives of leading manufacturers of gas cleaning equipment. The non-profit group has elected John T. Doyle, The Thermix Corp., Greenwich, Conn., as its first president. Other officers elected at the organizational meeting in Louisville, Ky., were L. L. Andrus, Wheelabrator Corp., Mishawaka, Ind., vice-president; and John G. Liskow, American Air Filter Co., Louisville, Ky., treasurer and temporary secretary.

The Institute lists among its purposes to provide for improved trade practices among its members; to perfect the standards of design and operation of gas cleaning equipment; to perfect standards of testing in various fields served by industrial gas cleaning equipment; and to collect and disseminate lawful information of value to members of the Institute, the industry, and the public regarding the several products of the industry and their application to industrial gas cleaning.

Original membership is composed of representatives from American Standard-American Blower Co., American Air Filter Co., Aerotec Industries, Buell Engineering Co., The Ducon Co., Joy Manufacturing Co., Kirk & Blum Manufacturing Co., Koppers Co., Northern Blower Co., National Dust Collector, Pangborn Corp., Pulverizing Machine Div., Peabody Engineering Corp., Research-Cottrell, Inc., Torit Manufacturing Co., Western Precipitation Corp., Wheelabrator Corp., and Green Fuel Economizer Co.

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Reduces sound power

for whisper-quiet efficient power exhauster ventilation

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• **The QT SOUND CONTROL CURB** absorbs, in just 10" of space, as much noise as 18 feet of lined duct 14" in diameter and 1" thick.

• **The QT SOUND CONTROL CURB** produces a speed reduction equivalent to 43% of actual speed . . . a 1725 rpm fan, for example, sounds as though it were turning at 980 rpm.

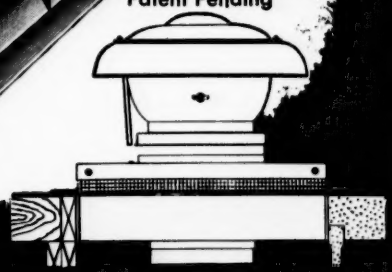
• **The QT SOUND CONTROL CURB** reduces a power exhauster's sone value (apparent loudness to the human ear) by approximately two-thirds.

• **The QT SOUND CONTROL CURB** offers effective noise control in an easily-installed, self-flashing, prefabricated curb.

Leader in functional IMAGINEERING . . .

Four sizes. Overall height is 10" or 11" mounted like a conventional curb with or without cant strip. Can also be installed into roof for lower contour.

Patent Pending



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WASHINGTON OVERTONES

by LORING F. OVERMAN

● Among many 1960 overtones of direct interest to heating, ventilating and air-conditioning industries, one is particularly significant. It is the coming tug-of-war between coal and petroleum industries, involving legislation to determine a national fuels policy.

The battle is touched off by a pending Senate resolution to create a Joint Senate-House committee to hold hearings and recommend a fuels policy designed ostensibly to assure adequate fuel supplies in a national emergency.

Procedure, observers say, would include end-use restrictions on certain fuels, import curbs on petroleum products, and other regulations which petroleum producers say would deprive consumers of freedom of choice.

Both petroleum and coal are planning a big-scale contest, with multi-billion dollar markets at stake.

Congressional insistence upon an early adjournment, in time for the Presidential nominating conventions in July, will undoubtedly block any action on the fuels policy question at this session. With the coming of the 87th Congress, battle lines will have been drawn and there will be action aplenty.

● Even during the hurry-up session, Congress may find time to provide for expansion of coal research activities of the Interior Department's Bureau of Mines. Formation of an independent Coal Research and Development Commission is considered unlikely, but a substantial budget for coal research is on the "probable" lists of Interior Secretary Seaton.

● Continuation of the oil import program despite heated criticism is expected, the Administration being convinced that the plan is functioning quite successfully.

Efforts to exempt independent natural gas producers from Federal utility-type regulation will also be made during the current Congressional session. Producers favor the legislation; consumers oppose. De-control is considered unlikely.

● Legislation proposing an $80 million expenditure annually for 10 years (HR3610) to assist communities in constructing pollution-control facilities may be able to clear Congressional hurdles, if not a veto. The measure has been passed by the House (June 1959) and Senate (September 1959) and has been returned to the House for conference. Favorable action is anticipated.

The subject of water resources is becoming increasingly troublesome, and Washington is hopeful that some solution may follow a report, due January, 1961, by the Senate Select Committee on National Water Resources. The committee has been charged with making an exhaustive study of the relationship between water resources and the national interest. The committee's findings are to be accompanied by recommendations concerning actions necessary to provide adequately for population increases expected by 1980.

● Typical of unrelated overtones that sometimes follow Washington actions is a just-issued report of the Select Committee on Small Business on alleged discriminatory practices against small business concerns in suburban shopping centers.

Principal purpose of the report (No. 1016, U. S. Senate Select Committee on Small Business) is to investigate claims of discrimination and to propose relief. A secondary dividend is a 40-page booklet providing heating and ventilating people with an interesting forecast concerning the probable size and character of the shopping center movement during the next decade or two.

● In addition to the usual problems of designing central air conditioning for large buildings, engineers planning installations in Washington, D.C., have another problem. Their ideas must also win approval of the National Capital Planning Commission.

Washington has no sky-scrapers—there's a 12-story height limit—so the prob-

(Continued on page 8)

CENTRIFUGAL TYPE

"Watchman"

CONDENSATION PUMPS

WC-8-20
UP TO 8,000 SQ. FT. E.D.R.
20 LBS. DISCHARGE
3450 RPM MOTOR

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- All Bronze Pumping Parts—Stainless steel shaft
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Note these "WATCHMAN" *Advantages:*

- **Centrifugal design of pump allows wider clearances between moving parts.**
- **Pump retains rated capacity after years of operation.**
- **"WATCHMAN" Pumps are economical to purchase, install, operate, and maintain.**
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VALVES, TRAPS, VACUUM AND CONDENSATION PUMPS, FORCED HOT WATER HEATING SYSTEMS. STOCKED AND SOLD BY LEADING WHOLESALERS OF HEATING AND PLUMBING EQUIPMENT.

WASHINGTON OVERTONES *(Continued from page 6)*

lem of locating and camouflaging air conditioning cooling towers is particularly complex. Another problem, insofar as Government construction is concerned, is that a tower intended to serve half-a-dozen existing buildings may have to be related to another building or two barely on the drawing boards.

Recent proposal for a temporary tower to replace individual plants serving the huge Commerce and International Revenue Service buildings was flatly rejected by the planning commission. In January a revised plan submitted by E. Roland Snyder, architectural chief of the General Services Administration, will place the tower where it will be hidden by a yet-to-be-completed building on the Federal Triangle. The new location will require re-routing a local bus turn-around.

● Heating, ventilating and air conditioning people who are watching Washington for tips on school construction may have to wait until 1961 for action. The Administration's program, as outlined in the President's State of the Union message to Congress, is as follows:

"It is designed to stimulate classroom construction, not by substitution of Federal dollars for state and local funds, but by incentives to extend and encourage state and local efforts. This approach rejects the notion of Federal domination or control."

The Administration program is a compromise, proposing to guarantee bond interest and principal for needy school districts. Other proposals would appropriate $1 billion of Federal funds annually for five years. It is conceded that this proposal cannot pass, and it is likely that the compromise will also be held up as an election year issue.

● For the entire year of 1960, ALL business will be affected by new Internal Revenue Service requirements for reporting expense account payments. The new reporting requirements must be incorporated in 1961 income tax reports of business activities for 1960. Copies of the new regulation are available at all Internal Revenue Service offices.

● Late-January hearings were scheduled by the House Banking Housing Subcommittee to study HR9371, a bill to provide one billion dollars in funds to permit additional purchases of mortgages on lower priced houses by Federal National Mortgage Association.

The bill, entitled "Emergency Home Ownership Act", explains in a preamble: "In general, it is the purpose of the bill to halt the serious slump in residential construction, to increase both on-site and off-site job opportunities, to help achieve an expanding full employment economy, and to broaden home ownership opportunities for the American people."

This program and one other, calling for loans to colleges for housing units, will be heavily pressured during the session. Administration has indicated it considers even a half-billion dollar mortgage-buying program too high. Also, Administration prefers government insurance of private financing for college housing.

Close action on these is anticipated, with little chance of other housing legislation passing.

● Segments of the heating-ventilating-air conditioning industry will be called upon during the next decade to participate in a 10-year civilian reactor program planned by the Atomic Energy Commission. Goal of the program is economic nuclear power.

Anticipated cost of the program—research, development, prototype construction and operation—is $1 billion for the decade, with industry and AEC sharing costs.

The civilian phase will be only a small part of Atomic Energy Commission spending. For 1960 and beyond, it is expected that the 1959 pattern of expenditures will be approximated. Out of a total budget of $2.5 billion for '59, AEC spent $700 million on raw materials, $713 million on production of nuclear materials, $491 million on weapons development, and $105 million on development of civilian nuclear power reactors.

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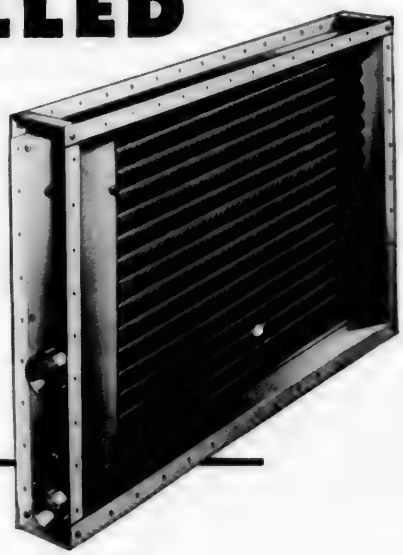

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Aerofin performance data are laboratory and field proved. You can safely specify Aerofin coils at full published ratings.

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Scientific Frontiers

"Chameleon" Coatings

Space satellites may soon lay claim to the chameleon's valuable ability of changing its color for protection. The idea involves the application of a heat sensitive coating for satellite skins to control internal temperature while the vehicle is whirling through space.

Devised by Rudolf X. Meyer, a scientist in the Physical Research Laboratory at Space Technology Laboratories, Inc., Los Angeles, the coating will change color thereby controlling the heat absorption and radiation qualities of the satellite. The idea is based on the well-known phenomenon that light colors reflect heat while dark colors absorb it.

Meyer stated that by applying his new coating the temperature inside the vehicle's shell would automatically be kept uniform. As the temperature of the satellite increases, its skin would become light in color, thereby allowing more heat to be reflected into space. Should the payload's internal temperature take a downward turn, the skin would become dark in color, thereby absorbing more radiation.

According to Meyer, the coating can either take the form of a paint-like substance or a plastic applied in several layers. He stated that he found about 35 substances while carrying out preliminary research which have this "chameleon" ability at the required temperature level. For instance, one particular coating changes with increasing temperature from red to yellow. In the case of polymer compounds, use is made of the reversible transition from the sol state to the gel state as the temperature increases.

The importance of protecting satellite payloads from temperature extremes was dramatically brought home to STL scientists during the flight of Pioneer I which traveled some 70,000 miles from the earth in October, 1958. For that experiment they calculated conditions under which the satellite instruments had to operate and a fixed temperature control paint pattern was applied. As a result, when the satellite went slightly off course, temperature conditions changed, no adjustment was possible and some of the instrumentation failed.

Had Meyer's coating been available when the Pioneer I satellite was constructed, it might still be in orbit and giving vital information today.

Food Irradiation

Millions of dollars and a decade of intense research have gone into developing food irradiation as a processing technique. Today, answers to some of the big problems are slowly coming in. However, food irradiation is still plagued by unresolved questions in the areas of public acceptance, wholesomeness, and economics.

Researchers are optimistic, but are proceeding with caution, since irradiated foods must be acceptable to the consumer in taste, odor, appearance, and texture when they are first placed on market shelves. The big push now is on resolving the basic mechanisms of radiation reactions, with an eye toward blocking those that cause flavor and texture damage.

The performance picture is mixed. Radiation doses vary from around 7000 rads for low levels, through the range of 50,000 rads to 1 megarad for pasteurizing, and on up to 3 to 5 megarads for sterilizing. Pasteurizing shows the most immediate promise. Shelf life of chicken, for instance, can be extended some 21 days by pasteurizing doses of radiation. Such doses can also prevent the sprouting of potatoes and delay the molding of strawberries.

Fish and certain other types of seafood will most likely be the first irradiated products commercialized. Irradiation does not affect texture, color, flavor, or odor of many fish items, according to tests.

Milk performs badly, and shell eggs are just about out as an item for irradiation, since whites become water thin. Frozen eggs show some promise, however, even though there is a noticeable, mild effect on flavor and baking properties.

Most research today is going into meat, and of this effort, beef gets the biggest share. It is the most important item from both the military and the civilian standpoint. It is also the worst performer.

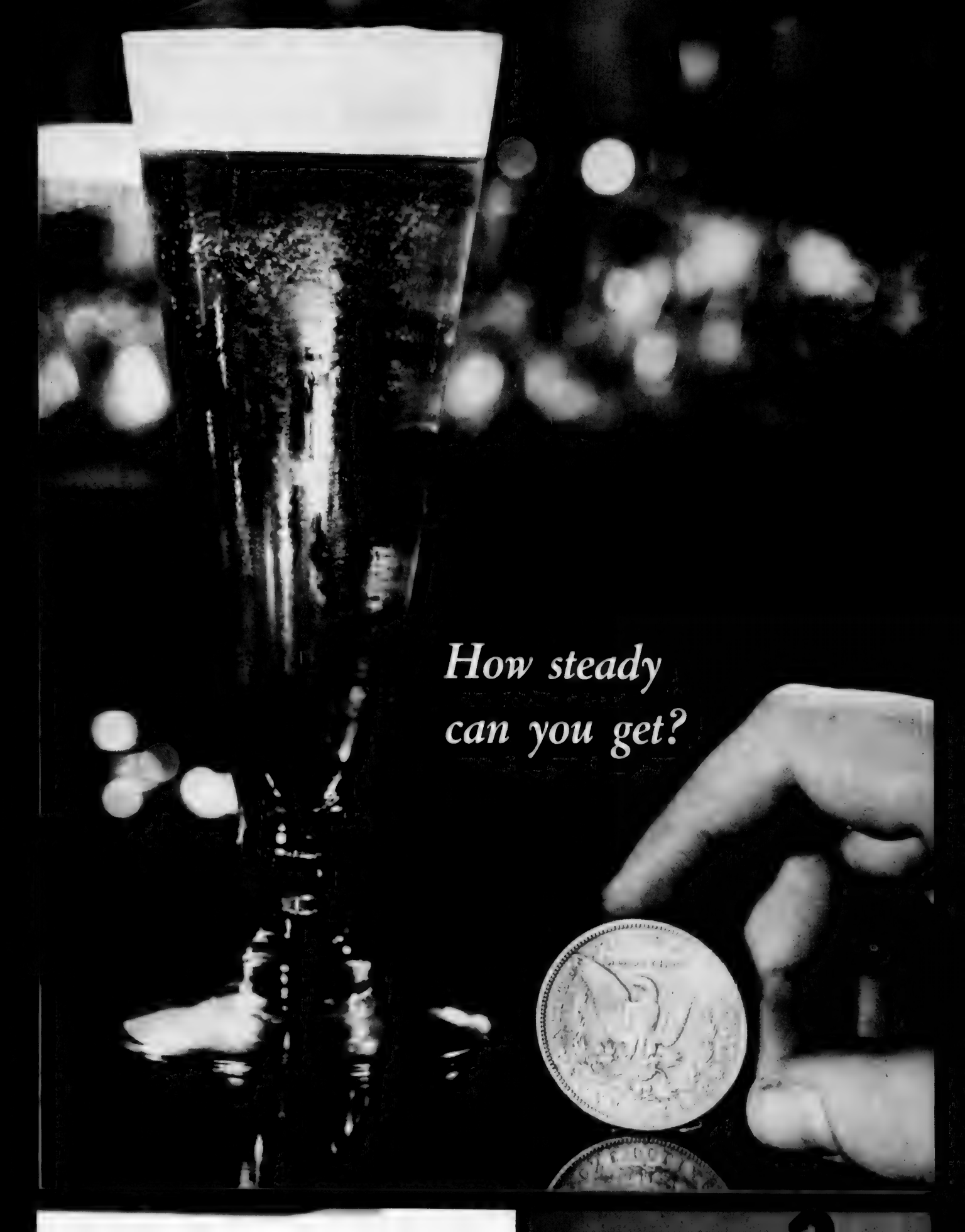
Meats other than beef have not fared too badly under irradiation. Pork, for instance, is almost unaffected. Chicken likewise develops very little off-flavor. Lamb and veal fall between pork and beef, but their market volume is not too significant.

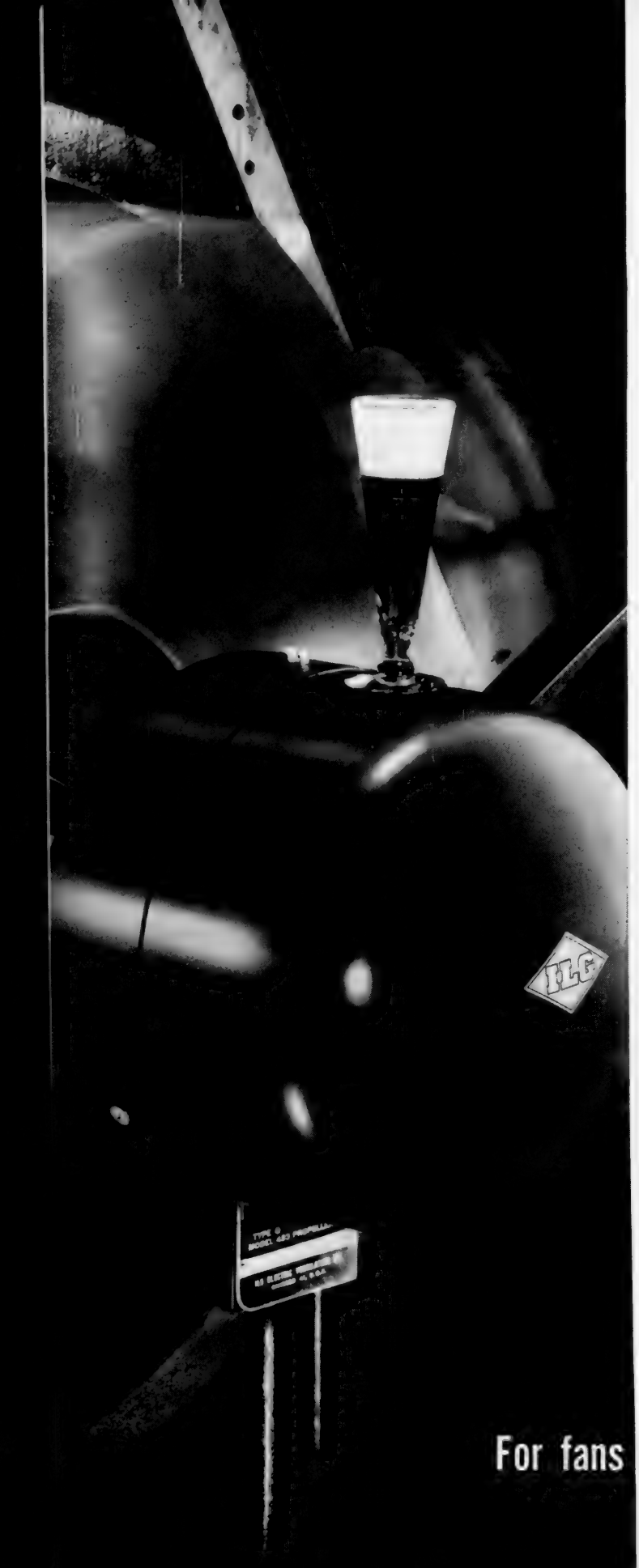
Off-flavor in beef has been traced to the formation of carbonyls, free amino acids, and volatiles, such as methyl mercaptan, and hydrogen sulfide. Certain techniques, such as removal of oxygen from the irradiation atmosphere, the use of free radical acceptors, and freezing the meat before irradiation help some by limiting the influence of free radicals. However, some off-flavor is still present, and other techniques are needed.

Licking the off-flavor problem is only part of the struggle. The foods must meet Food and Drug Administration requirements for wholesomeness. A huge, multimillion-dollar program to get proof that such foods are not harmful is now being sponsored by the U. S. Army Quartermaster Corps along with the Office of the Surgeon General and FDA.

The third area still holding unresolved questions is that of economics. Theoretical and laboratory cost estimates form the only basis for economic evaluation right now. But the U. S. Army ionizing radiation center "pilot plant" being built at Stockton, Calif., should come up with some cost figures that will clarify the picture.

Whether or not cost will be the determining economic factor is a subject of debate in food irradiation circles. Some feel that costs must be competitive if the process is to be economically acceptable. But at the same time, others feel that irradiated food products will be successful regardless of added costs, as long as they are acceptable to the consumer and offer him benefits.


How steady
can you get?



When you get ILG vibration is

Put a full Pilsner on any Ilg propeller fan. Flip the switch so the fan runs at full speed, just as you see it on this unretouched photo.

Now check the glass. Any bubbles? None.

Ilg fans and ventilators eliminate vibration . . . cut down noise, too. Reason? Careful dynamic balancing of all component parts. Electronic checks of motor and fan wheels—before and after final assembly—make certain that smooth, silent operation is as much a part of each

Follow the Flame and see why Ilg direct-connected propeller fans always run "cool." Vent pipe sucks in outside air that *pressure-cools* the permanently lubricated, Ilg-built motors, both the single-phase permanent-split capacitor and 3-phase types. To find out how Ilg offers operating cost advantages of *open-type* motors plus better protection than *totally enclosed* motors, send for Catalog 159.

For fans built to satisfy your "specs"...

fans and ventilators never a problem

piece of Ilg equipment as the "One-Name-Plate" guarantee of performance.

For further information, write for catalogs covering the complete line of Ilg electric ventilating equipment.

Each Ilg product shown carries the rating seal of the Air Moving and Conditioning Association Inc.

Short in Height . . . Long on Performance. Ilg Type LSQ power roof ventilators have direct-connected, patented "Q" Type fan wheels that pass air over blade smoothly, eliminate noisy turbulence. Low starting torque lengthens life of 3-phase and permanent-split capacitor single-phase motors. Choice of 11 sizes. Write for Bulletin 2302. For facts on type L-CRF ventilators with *airfoil* centrifugal fans and BC blades, send for Bulletin 2701.

Perfect Balance. Every Ilg-built centrifugal fan wheel—with backward curved (BC) blades and *airfoil* design that eliminates eddy currents and turbulence—passes dynamic balancing "check-out" tests before being direct-connected to 3-phase or permanent-split capacitor single-phase motors.

Smooth Air Intake. Ilg centrifugal fans feature large air-intake area with gently curved inlet contours that assure smooth entry of air. No bearings or bearing supports to hamper intake air flow. No belts or pulleys. No space-wasting separate motor mountings. For full details on units for operations to 9" static pressure, write for Bulletin 257.

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ILG ELECTRIC VENTILATING COMPANY
2851 N. Pulaski Road, Chicago 41, Illinois
Offices in More Than 57 Principal Cities
Member of Air Moving and Conditioning Association, Inc. (AMCA)

NEWS OF THE MONTH

Momentum of 1959 Nonresidential Starts To Carry 1960 Construction 3% Higher

Building construction during 1960 is estimated to be 3% above that of 1959 in dollar volume of contracts according to the Construction Industry Division, Business and Defense Services Administration, Department of Commerce. The figures for the two years are shown in the accompanying tabulation in which both public and private building in the various categories have been combined.

	1959*	1960**
Residential	$23,150	$22,400
Industrial	2,290	2,825
Offices and warehouses	1,925	2,225
Stores, restaurants, garages	1,925	2,225
Religious	925	1,050
Hospital and institutional	995	1,150
Educational	3,205	3,350
Social and recreational	540	700
Administrative and service	590	700
Other non-residential	705	700
	$36,250	$37,325

*Estimated for last two months by Business and Defense Services Administration, Department of Commerce
**Estimated by BDSA

According to the Department of Commerce, the effect of a big carryover of construction activity for certain types of structures from one year to the next is especially indicated by the influence of nonresidential buildings expenditures on total private expenditures in 1960. The anticipated rise for all private types, from $37.3 to $38.8 billion in the face of a $650 million drop in housing volume and a $200 million drop in farm volume, is mainly due to a $1.6 billion rise in nonresidential buildings caused in part by carryover of work begun in 1959.

Competition Spurs Building

Industrial construction, after reaching a peak of almost $3.6 billion in 1957, reacted to the economic downturn in 1958 by a sharp drop of almost one-third and should have reached a low point in 1959 at slightly below $2 billion. The 1960 gain of about $500 million, representing a rise of more than one-quarter over 1959, would return industrial outlays to only $2,450 million. Present industrial building programs are probably less influenced by the need for greater capacity than by the need for meeting competition with more efficient production facilities designed to achieve lower unit costs. The growing requirements for research and development are also a factor.

Commercial construction in 1960 will likely record even greater gains than in 1959. Office buildings and warehouses will reverse the 1959 downtrend because many large office building projects under way in 1959 will contribute heavily to activity in the next 12 months. This category has included a great many large projects in recent years. Office buildings plus stores, restaurants and garages promise to account for the same value of expenditures *in both 1959* and 1960.

Strength in these categories arises from the continued trend towards suburbanization throughout the United States, the need for parking facilities in central city areas, and from the high level of disposable personal income which continues to spark new peaks in the volume of retail business. New shopping center construction should continue its strong pace but lag behind the recent high level of residential activity in outlying areas. However, for the first time, stores, restaurants and garages will likely account for outlays of over $2 billion—double the annual rate of only 7 years ago.

Religious Building Over $1 Billion

Other types of private building are due to be very strong in 1960. Construction of religious buildings should exceed the billion dollar mark. After being interrupted in 1959 by the economic slowdown of 1958, private school building will continue its regular uptrend of recent years. Federal aid will be an important factor in the stimulation of private hospital construction. Social and recreational building activity in 1960 is expected to rise substantially under the influence of high incomes, and the effect of leisure time on national spending habits.

The physical volume of public educational construction in 1960 is expected to stay at about the same level as in 1959, cost increases negating the small dollar gain. Although many new bond issues have been authorized for educational construction, an unfavorable money market continues to retard the translation of these authorizations into funds for new schools.

(More news on page 16)

RANDOM TESTING PATTERN PRECEDES 1960 ARI DIRECTORY

A short time prior to publication of its 1960 Directory of Certified Unitary Air-Conditioners, Air-Conditioning and Refrigeration Institute, Washington, D. C., announced that it had established a random testing pattern under which at least four units will be tested each month to determine whether their rated capacities are met by the stock units themselves.

Units tested are withdrawn from stocks of distributors. A number of units have already been tested by the independent laboratory under contract to ARI. No manufacturer knows when or what model of his output will be subjected to test. Failure to comply with the published data can result in revocation of the privilege of using the ARI seal of certification.

The certification program received an additional boost recently from Air-Conditioning and Refrigeration Wholesalers, Columbus, Ohio, which, in formal resolution, has sanctioned the program and promised to solicit manufacturers to certify their products under the program.

The 1960 edition of the Directory lists 1995 models of about fifty participating manufacturers who represent more than 90% of total U. S. production of unitary air conditioning equipment.

The family has grown!

... in size ... in importance

The addition of a new and finer McDonnell 2-inch valve rounds out a line of safety relief valves for hot water space heating boilers that fulfills a vital need supremely well.

To know how true this is go back over the modern history of relief valves. With the rapid increase in closed systems, casualty companies, the National Board, and others concerned with boiler and heater safety went to work . . . and the net result was today's commendable A.S.M.E. Boiler Code calling for certified Btu-rated relief valves.

Closely following this work, McDonnell & Miller developed the first of all Btu-rated relief valves. They were not only first into the field; they are still first. They not only conform to the letter of the code; they go beyond this: *introduce new standards of their own.*

For Hot Water Space Heating Boilers

McDonnell Valve No.	Boiler Size Btu./hr.	Opening Pressure	Inlet	Outlet
230-¾ IN.-30	303,000	30 lbs.	¾"	¾"
240-¾ IN.-30	513,000	30 lbs.	¾"	1"
230-1 IN.-30	743,400	30 lbs.	1"	1"
240-1 IN.-30	910,000	30 lbs.	1"	1¼"
230-1½ IN.-30	1,025,100	30 lbs.	1½"	1½"
240-1½ IN.-30	1,560,000	30 lbs.	1½"	2"
240M-3	2,313,000	30 lbs. 36 lbs.	2"	1" 2"
240M-4	2,710,000	30 lbs. 36 lbs.	2"	1¼" 2"
240-2 IN.-30*	3,130,000	30 lbs.	2"	2½"
240-2 IN.-36*	3,550,000	36 lbs.	2"	2½"

*Recommended installation: 36 lb. opening valve, with smaller auxiliary valve set at 30 lbs. for thermal expansion.

New Bulletin P-33 gives up-to-the-minute facts

- A new bulletin shows why and how the entire rated capacity of McDonnell Relief Valves is obtained without diaphragms or other auxiliary lifting devices.
- It shows how this operation—this operation so basic to safety—is ideally accomplished by using specially calibrated "low rate" springs, matched to disc area to give smooth precise lift and tight closure.
- It explains the widely adopted McDonnell principle of progressive settings that keeps discharge in step with function . . . small valve relieving normal expansion; large stand-by valve ready for the emergency.

These and many more significant facts are covered in the bulletin. Note the accompanying table listing a valve for practically every boiler—McDonnell quality straight across the board.

Coupon brings your copy

McDONNELL & MILLER, Inc.
3500 N. Spaulding Ave., Chicago 18, Ill.

Doing One Thing Well

Your Jobber Stocks Them

McDONNELL

Send me a copy of new Bulletin P-33 covering McDonnell Safety Relief Valves for hot water space heating boilers.

COMPANY NAME_____

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Mail to: McDonnell & Miller Inc., 3500 N. Spaulding Ave., Chicago 18, Ill.

NOW PRODUCERS SMILE WHEN TOLD FILM "SMELLS"

A process ingenious in its simplicity is delivering specific odors via the air conditioning system to viewers of a film at the DeMille Theater in New York City. A travelogue, "Behind the Great Wall" is an ideal vehicle for this olfactory adventure. It contains scenes which greatly lend themselves to this kind of treatment: a tiger hunt, incense burning in a Buddhist temple, bombs bursting, fireworks exploding, a bonfire, a grove of evergreens, and so forth.

The problem was how to add "essence of tiger" to a visual image on the screen and the roar emanating from the stereophonic sound system. The solution consisted of adding an odor track to the film, having a chemical company bottle the various smells in pressurized containers, and making the proper electronic and mechanical connections between the two processes.

Let's follow a typical sequence, using the tiger as an example. About 35 seconds before the tiger will appear on the screen, the odor track triggers a signal from the projection room up to the fan room. There, two turntables containing from 30 to 40 aerosol containers each have already aligned the proper set of containers with two duct openings. When the signal is received, plungers depress the aerosol actuators, thereby releasing sprays of the required smell into the suction side of the blower system. At precisely the time the image of the tiger appears on the screen, air bearing the tiger's gamy scent is discharged from diffusers throughout the theater.

Fifty to sixty percent of this air is recirculated back to the fan room where the tiger smell is removed by a static-electronic disintegration system, making the air ready for another charge of odor. Process is called AromaRama, and was conceived and developed by Charles Weiss. Supervision for modification of air distribution systems in theaters equipped with the process is headed by Bernard Lepselter, of Adams Engineering Co., Inc., New York City.

National Bureau of Standards Adopts New Prefixes for Units

The National Bureau of Standards has decided to follow the recommendations of the International Committee on Weights and Measures to use new prefixes for denoting multiples and sub-multiples of units. The Committee adopted the prefixes at its meeting in Paris in the fall of 1958.

In addition to the eight numerical prefixes in common use, which are given in the table below, the Committee expanded the list by adding the four prefixes marked with an asterisk. Thus, for example, 10^{-12} *farad* is called *1 picofarad*, and is abbreviated *1 pf*.

Multiples and Sub-Multiples	Prefixes	Symbols
$1\,000\,000\,000\,000 = 10^{12}$	tera*	T
$1\,000\,000\,000 = 10^{9}$	giga*	G
$1\,000\,000 = 10^{6}$	mega	M
$1\,000 = 10^{3}$	kilo	k
$100 = 10^{2}$	hecto	h
$10 = 10$	deka	dk
$0.1 = 10^{-1}$	deci	d
$0.01 = 10^{-2}$	centi	c
$0.001 = 10^{-3}$	milli	m
$0.000\,001 = 10^{-6}$	micro	μ
$0.000\,000\,001 = 10^{-9}$	nano*	n
$0.000\,000\,000\,001 = 10^{-12}$	pico*	p

OPTIMUM VOLTAGE DETERMINED TO PROTECT STEEL PIPELINES

A potential of -0.77 volt, previously shown to protect steel cathodically against corrosion in low-resistivity environments, also afforded the highest degree of protection in a high-resistivity soil, according to a recent National Bureau of Standards experiment. This potential, referred to a saturated calomel electrode, is equivalent to -0.85 volt referred to a copper-copper sulfate electrode. In the present study it was found that the best results were achieved when *IR* (voltage) drop between the reference electrode and the metal, caused by the protective current, was excluded from potential measurements.

As the underground corrosion of iron or steel is mainly an electrochemical phenomenon, NBS explains, electric potential at which a metal structure should be held to prevent the destructive process is of practical importance. Insufficient potential will give inadequate protection. On the other hand, maintaining a greater potential than is needed represents wasted electric energy.

Earlier studies of cathodic protection at the Bureau were conducted with soils and water having resistivities of less than 1,000 ohm/cm. In these environments, measured potentials were virtually free of *IR* drop. In high-resistivity environments, however, measured potentials made on underground structures often include considerable *IR* drop.

(More news on page 132)

New from American-Standard
Industrial Division

Air-Lift† for modern buildings

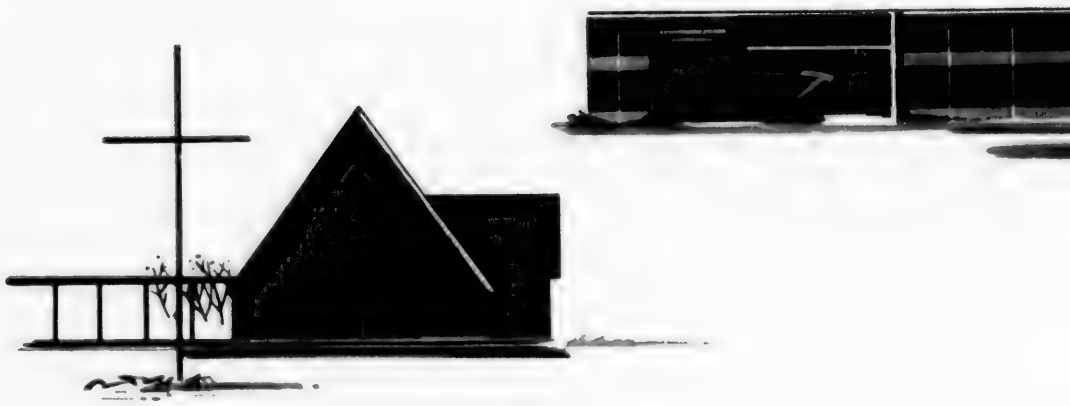
Air-Lift is a new concept of coordinated products and services from American-Standard Industrial Division. Its purpose is to help you lift the efficiency of modern buildings through better control of indoor climate. Air-Lift offers you one-source responsibility for air conditioning, heating, and ventilating equipment that is designed, engineered, and manufactured to a uniform standard of quality and performance.

To see how Air-Lift can benefit your building . . .

LIFT THE FLAP

†Service mark of American Standard

American-Standard Industrial Division **AIR-LIFT IN ACTION**



An indoor climate as modern a
with systems or compone

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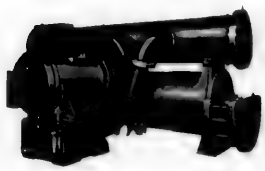
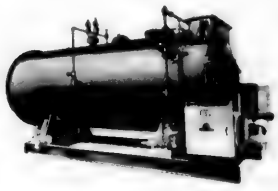
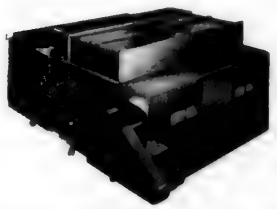
Select by the piece—buy by the package



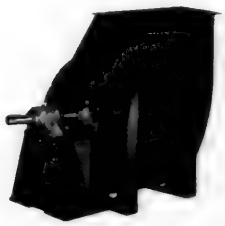
Centrifugal refrigerating machines for central-station air conditioning.



Firebox, scotch-type steel boilers and package units for heat, steam.



Central-station air conditioning units for public buildings, plants.



Centrifugal fans for high-pressure air conditioning, ventilating.

Self-contained air conditioners, air- and water-cooled types.

s the building itself, ents from a single source

Because new ideas in building design win acceptance by working better, providing more in comfort and convenience . . . air-conditioning systems must be as modern as the buildings they serve. This is the reason for Air-Lift.

With thousands of installations in all manner of structures—towering office buildings, sprawling shopping centers, hotels, motels, auditoriums—American-Standard Industrial Division has a comprehensive knowledge of air-conditioning problems. And, with a complete line of coordinated products for air conditioning, heating, and ventilating—American-Standard Industrial Division offers *all* the equipment for efficient climate control in any building.

Air-Lift can work for you. Call on us.

One-source responsibility

The heart of American-Standard Industrial Division's Air-Lift Service

Now . . . with the combined American Blower, Ross Heat Exchanger, and Kewanee Boiler product lines . . . American-Standard* Industrial Division offers *all* the major components for complete, integrated air-conditioning systems.

You benefit by getting heating, cooling, refrigerating, and ventilating equipment designed, engineered, and manufactured to work together. And—most important—you have one-source responsibility for its quality and performance.

Offices in all principal cities are staffed by product specialists whose practical knowledge of the selection and application of air-conditioning equipment may prove most helpful to you. May we serve you? AMERICAN-STANDARD INDUSTRIAL DIVISION, DETROIT 32, MICHIGAN. IN CANADA: AMERICAN-STANDARD PRODUCTS (CANADA) LIMITED, TORONTO, ONTARIO. EXPORT DIVISION, AMERICAN-STANDARD, NEW YORK CITY.

Products designed, engineered, and manufactured to work together

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Centrifugal Refrigerating Machines • Central-Station Air Conditioners • Package Water Chillers Room Fancoil Units • Induction Units • Multi-Zone Air Conditioners • Sprayed Coil Dehumidifiers • Air Washers • Cooling Coils • Self-Contained Air Conditioners • Cooling Towers • High-Pressure Fans

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Instantaneous Water Heaters for service-water, booster, or convertor duty • *Gyrol*® Fluid Drives to drive water-service pumps—eliminate compressed-air system or roof tank

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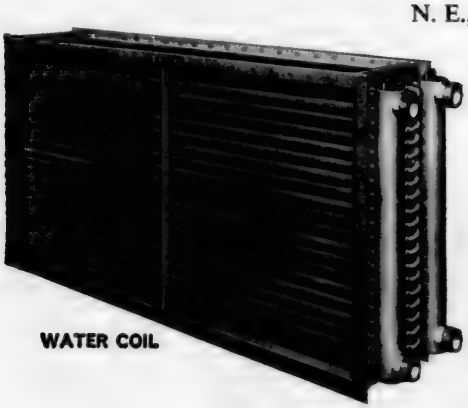
gives you...

STANDARD COILS · CUSTOM COILS

to meet any requirement and any design load

When you think of coils, think first of McQuay with the years of research and know-how which has made McQuay the nation's leading coil manufacturers. McQuay gives you the exclusive Ripple-Fin coils with tubes pressure expanded into wide, full fin collars to provide a permanent bond . . . actually forming a tube within a tube for maximum heat transfer. McQuay coils are made in 5/8", 1/2" or 3/8" tube diameters, one to twelve or more rows, and in the widest possible range of styles or capacities, with a choice of from one to fifteen fins per inch for maximum heat transfer efficiency and to permit accurate balancing of capacities with the design load. They are available for steam, hot water, cold water, direct expansion and refrigerant condensing, and can be made of any required or desired metal or combination of metals. When you specify McQuay you have selected the very best. For information on any coil requirement, call your McQuay representative, or write McQuay, Inc., 1619 Broadway Street N. E., Minneapolis 13, Minnesota.

one to 12 rows deep
one to 15 fins per inch



WATER COIL

DIRECT EXPANSION COIL

McQuay means Quality

McQuay INC.

AIR CONDITIONING · HEATING · REFRIGERATION

In the Chicago area you'll find hundreds of Arkla-Servel Sun Valley Gas air conditioners in food stores, drug stores, general stores, restaurants, taverns, halls, beauty parlors, medical centers, business offices, service offices, plant offices, small factories, small shops, repair shops, barber shops, branch offices... bringing year 'round comfort to customers and employees.

more and more Chicago businesses are cooling with GAS! Many Chicago firms need a compact, automatic unit that will both heat and cool at low cost. That's why – in a one year period – 275 Arkla-Servel Sun Valley Gas air conditioning units were specified and are being used in business places throughout the Chicago area.

With this central Gas unit, there's no need for fans, window air conditioners or separate cooling units. The design is so clean and simple that it can be installed wherever there is room... out in the open, on the roof, in the basement, or in the back room.

In addition to heating and cooling, the Arkla-Servel Sun Valley unit also cleans the air, dehumidifies and ventilates to assure year 'round comfort.

The Arkla-Servel Gas air conditioner is flexible, too – comes in 3½ and 5-ton units which can operate singly or be adapted to multiple installations depending upon the amount of space to be air conditioned.

If your customers and employees sweltered this summer, think now about installing a Gas cooling system before next year's heat wave is here. For specific information, call your local Gas company or write to the Arkla Air Conditioning Corporation, General Sales Office, 812 Main St., Little Rock, Ark. AMERICAN GAS ASSOCIATION

FOR HEATING & COOLING GAS IS GOOD BUSINESS

NO STARTING PROBLEMS

with

WAGNER CAPACITOR-START MOTORS

Quick Break Switch

The starting winding is disconnected from the line by this Wagner designed switch . . . test proved to make more than a million breaks. (That adds up to two starts per hour for 50 years!)

Quick Connect Terminals

Brass tabs on terminal studs permit quick, easy connection of leads . . . cut wiring time to speed assembly line production. Simply press the lead receptacle on to the stud—a positive connection is assured.

Pack more power into less space . . . give long troublefree service . . . are easy to hook up

Here are general purpose single-phase motors that have high starting torque and high pull-in torque. When used in the proper application and supplied with voltage close to their rating, they'll give positive starts every time. Troublefree operation is assured . . . thanks to the positive action of the Wagner governor mechanism and long life quick-break switch.

Wagner Type RK Motors pack more power into less space. Small enough to fit in tight spots, their ruggedness is built-in . . . permits direct mounting. They are available in a range from ⅙ through 5 horsepower, with sleeve or ball bearings, and with rigid bases or resilient mountings. And, sleeve bearing fhp models can be operated in any position.

Get these motors from leading distributors in your city, or from Wagner Sales Offices in 32 cities across the country. Your Wagner Sales Engineer will be glad to help you select the right motor for your application. Wagner Bulletin MU-217 gives full details on Capacitor-Start Motors.

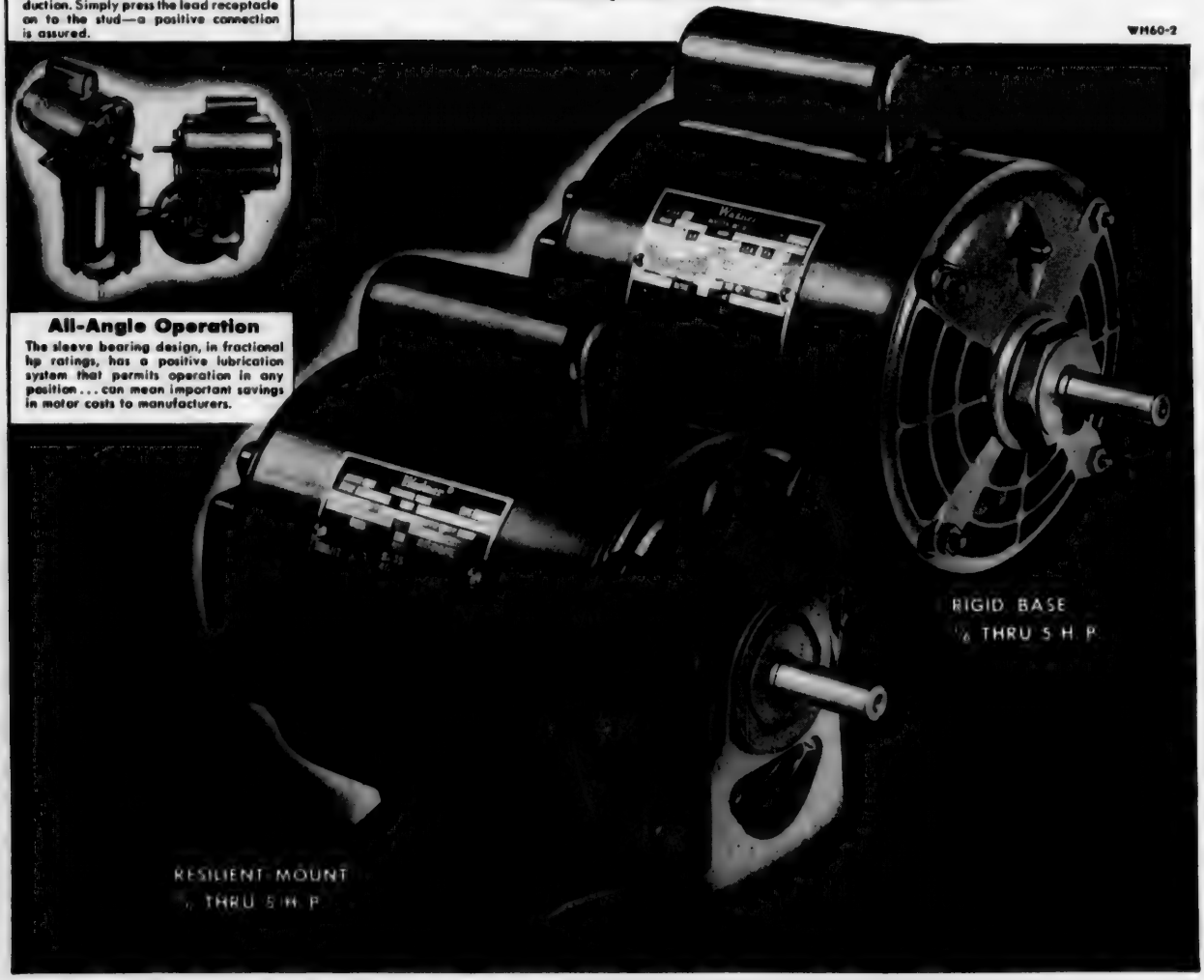
Wagner Electric Corporation

6463 Plymouth Avenue, St. Louis 33, Missouri

WH60-2

All-Angle Operation

The sleeve bearing design, in fractional hp ratings, has a positive lubrication system that permits operation in any position . . . can mean important savings in motor costs to manufacturers.



More Competitive Bidding With YORK Packaged Units!

NO OTHER AIR CONDITIONER OFFERS SO MANY IMPORTANT SAVINGS BOTH NOW AND LATER!

York Embassy

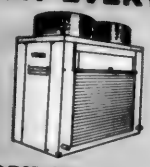
SAVE...the expensive installation costs that *run up* the bid! York Packaged Air Conditioners are easily installed without extensive overhauling of the building! They may even be used without ductwork if desired.

SAVE...by quoting on a pay as you go basis! The important areas can be air conditioned first and additional units added as budget permits. This permits a rock-bottom base quotation that would be vital on many jobs.

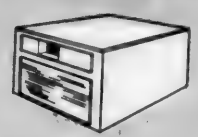
SAVE...the customer 15% or more on operating cost with York's step-capacity operation! Each unit contains as many as 4 independent compressors. As heat increases, an additional compressor swings into action...cuts off as heat decreases. Customer pays only for the cooling he needs!

There's no interruption of business or loss of operating revenue, either, with York Packaged Units. And individual units can be turned off when not in use, to cut operating costs even more! Write today for full details!

THERE'S A YORK AIR CONDITIONER TO FIT EVERY INSTALLATION NEED!



YORK Champion
Air-cooled! Remote!
Up to 15 Ton capacity.



YORK Pathfinder
Self-contained! Air-cooled!
Up to 4 Ton capacity!

York Puts More Into Every Unit, So You Get More Out of It.

All Units Backed by Blue Chip Pledge of Performance

YORK. BW BORG-WARNER RESEARCH & ENGINEERING MAKE IT BETTER

YORK CORP., SUBSIDIARY OF BORG-WARNER CORP. GRANTLEY ROAD, YORK, PA.

Air Conditioning, Heating, Refrigeration and Ice-Making Equipment • Products for Home, Commercial and Industrial Installations

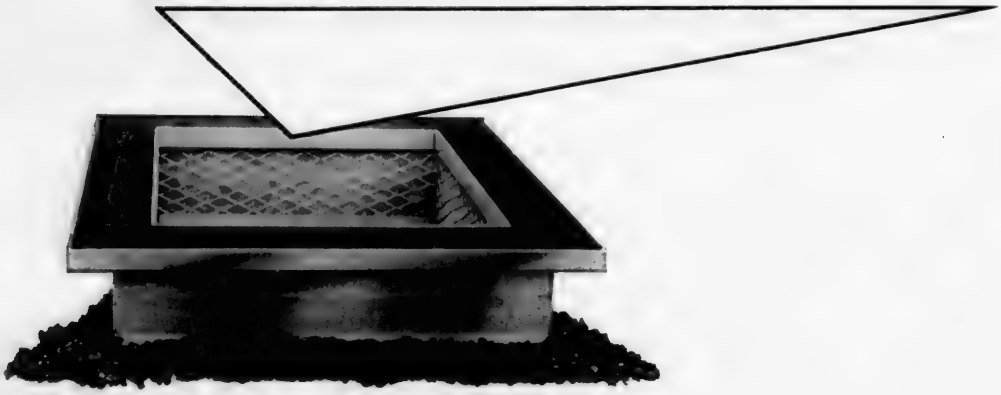
IT'S WHAT GOES INTO PENN'S SONOTROL CURB THAT MAKES IT SO DARN GOOD!

Ventilators fit like a glove when there's a self-flashing
EXTRUDED ALUMINUM
SONOTROL CURB*
on the job!

The newest way to curb roof ventilators eliminates the haphazards of field construction. Instead, you place your order for curb, ventilator and damper . . . everything fits . . . and there are no delays!

Penn devoted years to developing the Sonotrol Curb. Already in use in many installations, they're non-porous, seamless and weathertight! All aluminum construction reduces roof loading . . . makes them easy to install. Special acoustical insulated lining quiets roof exhauster sounds appreciably, and eliminates condensation.

Get into this modern way to curb now by requesting Bulletin SCE-89 from your local Penn Ventilator man or write direct.



PENN VENTILATOR CO., Inc.
PHILADELPHIA 40, PENNA.

A leading manufacturer of Powered and Gravity Roof Exhausters and Accessory Equipment for over 30 years.

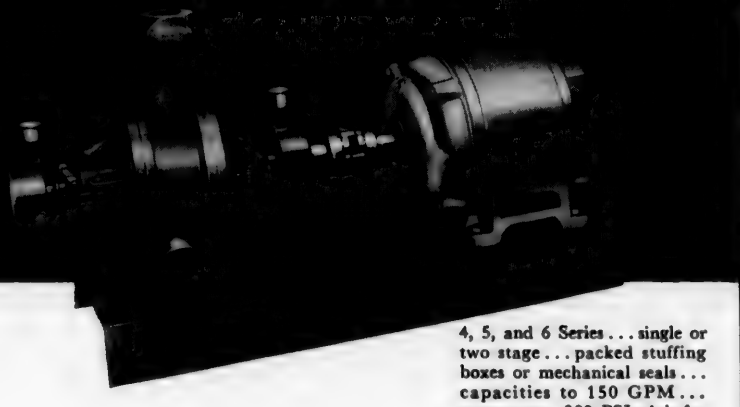
Representatives and Distributors in Principal Cities
Charter Member of AMCA

*Your roof exhauster won't be as quiet as it should be unless you use the Sonotrol Curb

MAXIMUM EFFICIENCY • LONGER SERVICE LIFE
• EASIER MAINTENANCE WITH

AURORA® APCO

TURBINE TYPE PUMPS



4, 5, and 6 Series . . . single or two stage . . . packed stuffing boxes or mechanical seals . . . capacities to 150 GPM . . . pressures to 300 PSI. Ask for Bulletin No. S-111.

★ Long service life . . . with no metal-to-metal contact within the pump channel, wear is minimized.

★ *Easy Maintenance* . . . removal of end covers permits complete disassembly without breaking or disturbing the suction or discharge connections or motor-pump alignment.

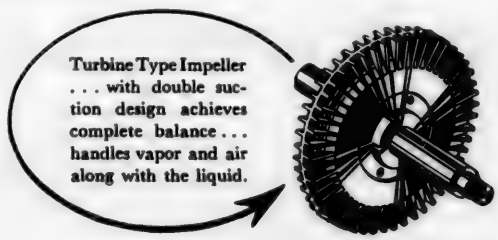
★ Complete hydraulic balance . . . achieved with double suction design . . . all hydraulic thrust on outboard bearings is eliminated.

★ Will not vapor bind . . . turbine type impellers handle vapor and air along with the liquid to eliminate vapor lock within the pump.

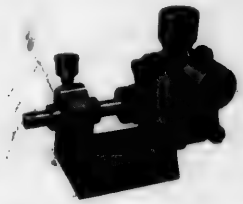
★ Wide operating range . . . constant capacity is maintained over wide head variations or fluctuating conditions—adjust quickly to changed operating conditions.

★ Ideal for low capacity, high pressure applications . . . boiler feed, condensate return, circulation services, booster services, LPG service, liquid transfer, water treatment, and filter services.

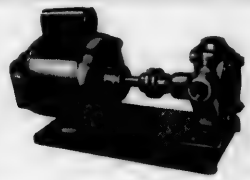
WRITE TODAY FOR FREE DESCRIPTIVE LITERATURE!



Turbine Type Impeller . . . with double suction design achieves complete balance . . . handles vapor and air along with the liquid.

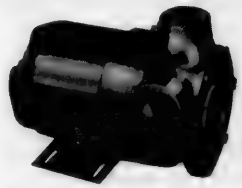


3 Series . . . Single stage . . . packed stuffing box . . . flexible coupling drive . . . capacities to 12 GPM, heads to 50 feet. Ask for Bulletin U-111-A.

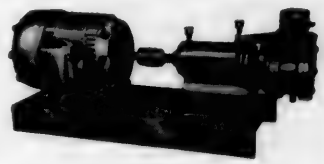


32 Series . . . single stage flexible coupling drive . . . mechanical seal . . . lubricated-for-life bearings . . . capacities to 10 GPM, heads to 250 feet. Ask for Bulletin U-111-B.

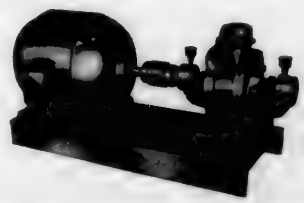
Type V31 . . . single stage close coupled . . . mechanical seal . . . self priming . . . capacities to 15 GPM, heads to 350 feet. Ask for Bulletin V-111-A.



Type V4 . . . close coupled . . . single stage . . . mechanical seal . . . capacities to 30 GPM . . . heads to 350 feet. Ask for Bulletin V-111-B.



Type Z4 Chemical Process . . . single stage or two stage . . . mechanical seal . . . capacities to 50 GPM . . . pressures to 400 PSI. Ask for Bulletin Z-111-A.



Type X40 . . . water jacketed packed stuffing boxes or mechanical seals . . . single or two stage . . . capacities to 60 GPM . . . heads to 350 feet. Ask for Bulletin 111XJ.

AURORA Always PUMPS

AURORA PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY

690 LOUCKS • AURORA, ILLINOIS

LOCAL DISTRIBUTOR IS LISTED IN THE YELLOW PAGES OF YOUR PHONE BOOK

Now—a new appearance concept for low-budget commercial installations

The "Power-Plant" Look

with Johns-Manville FIBROCEL Insulation!

Now you can bring the traditionally fine appearance and performance excellence of your power plant work to general commercial and industrial installations... with Johns-Manville Fibrocel® Insulation!

Why these power plant advantages? Simply because Fibrocel is molded! The only commercial insulation made (by a precision metal mold) to near-perfect roundness, with unmatched uniformity of size and line.

This means an immediate end to costly finishing, heavy jacketing, needless pointing up of cracks and apertures. Instead, Fibrocel gives you a tighter, better looking installation just as it is applied. Pipelines are gun-barrel straight, firm end to end. The look of a power plant!

Fibrocel's dimensional uniformity again pays off in fuel savings—pipe is always "dead center," with lengths butted tight to provide maximum insulating effectiveness.

Let us send you the informative new brochure, IN-155A. It gives you full details on Fibrocel's thermal performance. Illustrations show why Fibrocel installs easier . . . takes abuse, too. Keeps its fine appearance and performance excellence for the life of the installation. Write for it today!

Address Johns-Manville, Box 14, New York 16, N.Y. In Canada: Port Credit, Ontario.

JOHNS-MANVILLE PRODUCTS

JOHNS-MANVILLE

...Specify Fibrocel for the "POWER PLANT" look in installations like these (35F to 300F)

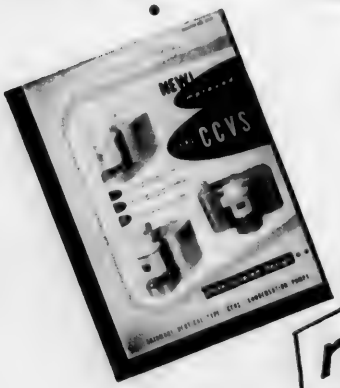
HOSPITALS
INSTITUTIONS

Specify Skidmore

One is just right for your application

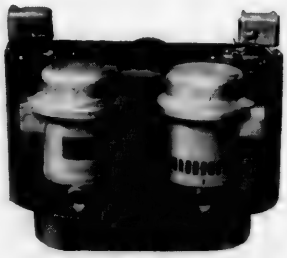
New Bulletins

No. 21-C



TYPE **CCVS**

redesigned



DUPLEX UNIT

SINGLE UNIT

Two outstanding vertical type pumps shown at right are fully described in the new Bulletin 21-C. Combining the latest features of centrifugal pump design — the New "CCVS" Pump is built in three single sizes and the duplex unit in either the two float switch or automatic alternator type.

Sales Representatives in Principal Cities

SKIDMORE PUMPS

SKIDMORE CORPORATION ST. JOSEPH, MICHIGAN

Allis-Chalmers tackled this motor problem "cold"

Even heavy icing couldn't freeze this motor. An Allis-Chalmers customer required that this open-type *Super-Seal* motor start even though embedded in ice.

Successful tests were conducted in the A-C Motor Laboratories where customers' motor needs point the way to continuous development programs.

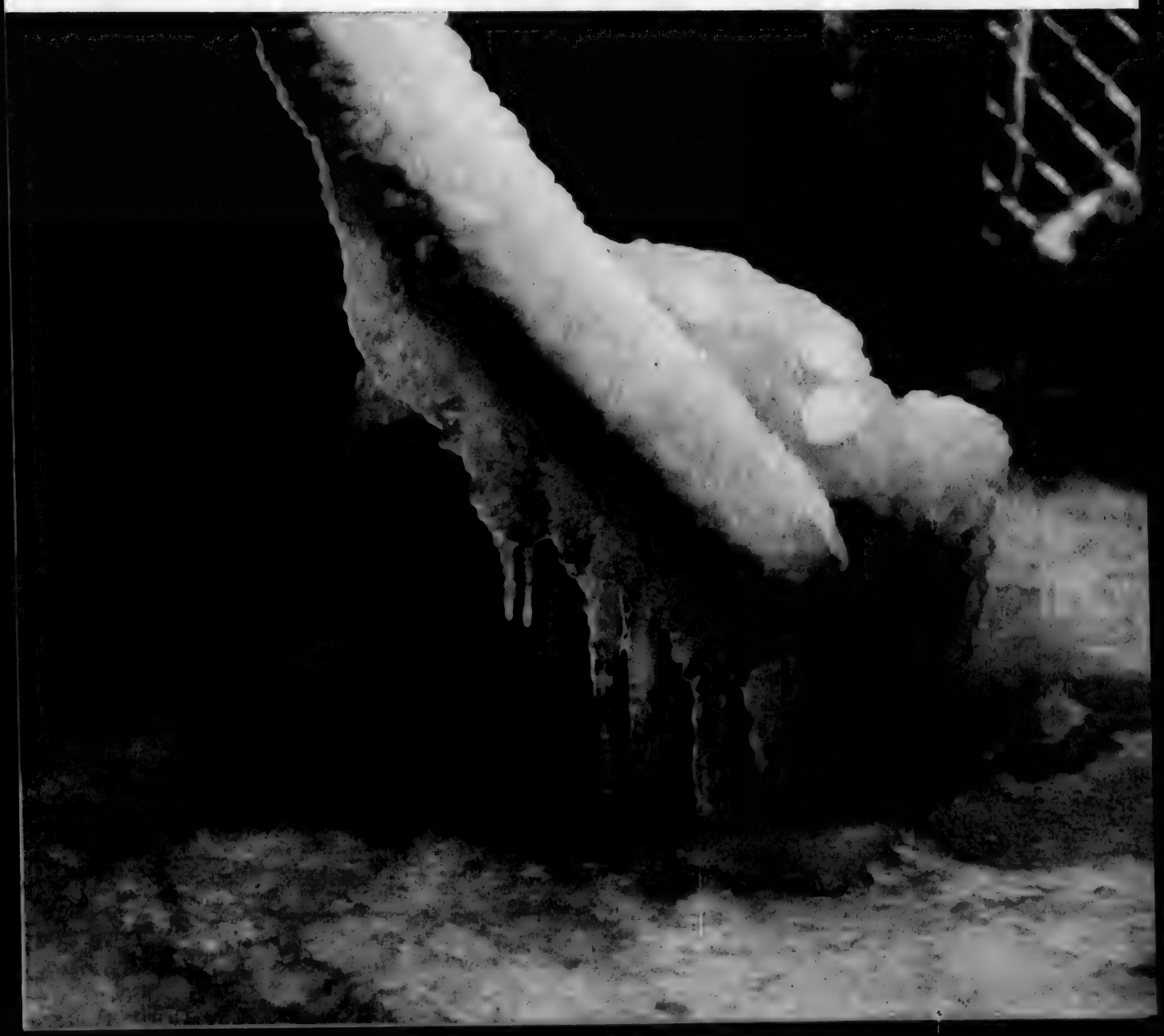
Research and testing of this type has established Allis-Chalmers as a pioneer-leader in the motor industry. It has led to the most complete line of integral-horsepower motors; it has led to tremendous acceptance of such A-C developments as *Synduction* and tube-type motors, and now *Super-Seal* motors.

You can benefit from this pioneer-leadership by contacting your A-C representative or distributor, or by writing Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

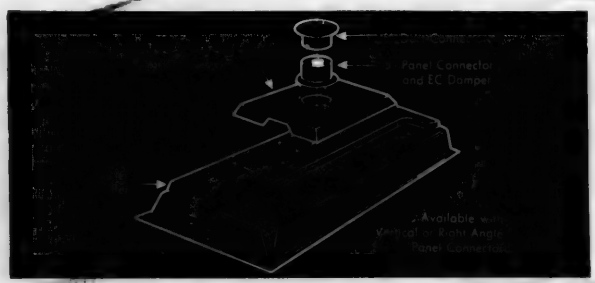
Super-Seal and *Synduction* are Allis-Chalmers trademarks.

ALLIS-CHALMERS A-C

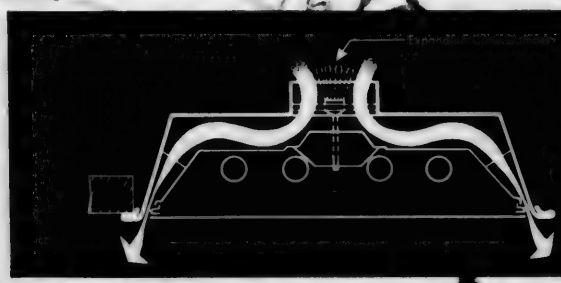
A-5956-G1



New concept in Air -

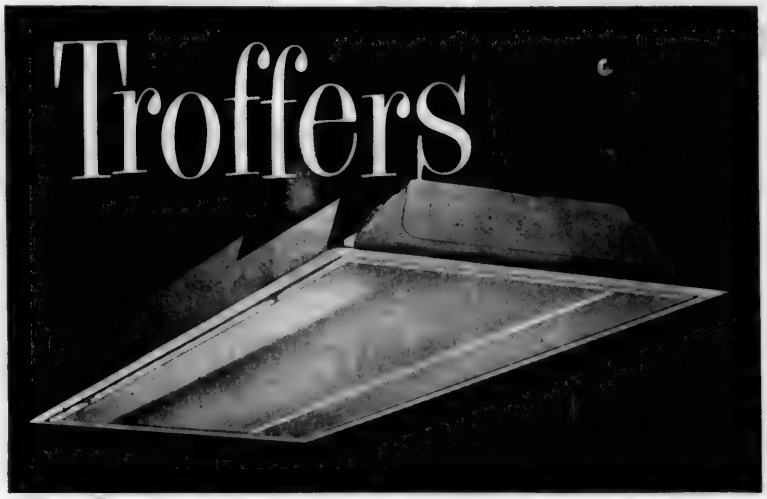


Units are easily installed, easily adjusted, and easily serviced.



Air is completely isolated from the light by double-wall construction—a patented Barber-Colman feature.

Diffusing Troffers



Patented* double-wall construction isolates air from light for

- Controlled air distribution
- Freedom from smudging
- Maximum lighting efficiency

*Patent No. 2564334, others pending.

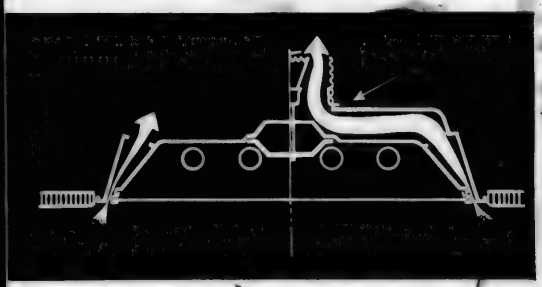
These units are the combined development of two leaders in their respective fields — Barber-Colman in engineered distribution of air and Day-Brite in engineered distribution of light. They ideally unite these two factors in a distinctive modular unit to provide the ultimate in human comfort and flexibility in interior design.

Air passes through a separate chamber completely isolated from the fluorescent tubes and is diffused into the room at low noise levels. Thorough aspiration at moderate velocities completely eliminates drafts.

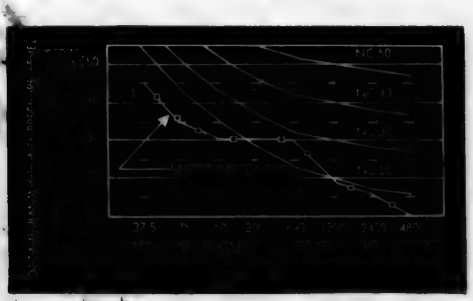
Physical separation of light and air eliminates smudging of the fluorescent tubes, reflector, and ceiling. There is no reduction in luminous area. Lighting output is maintained at uniform high efficiency because the fluorescent tube temperatures are maintained at optimum level, unaffected by air temperature and flow.

Combination diffusers may be used to handle either supply or return air and are available in 1 x 4 and 2 x 4 sizes with either two or four fluorescent tubes in a variety of glass, plastic, or metal enclosures.

Call Barber-Colman or Day-Brite for complete specifications — ask for new Catalog F-9768.



Combination units may be used for either supply or return air service.



Low noise assured – octave band sound data and NC ratings available.

BARBER COLMAN

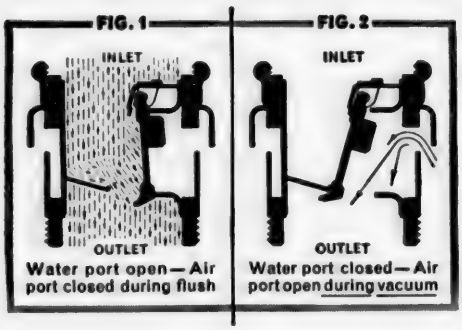
BARBER-COLMAN COMPANY

Dept. B, 1101 Rock Street, Rockford, Illinois

Uni-Flo engineered air distribution products and Electronic automatic controls

You pay no more for unequalled SLOAN quality...

Double PROTECTION with SLOAN Vacuum Breakers

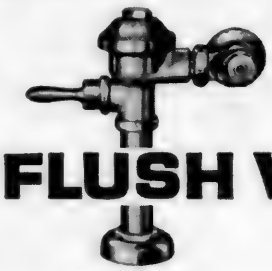


Municipal plumbing codes as well as U. S. Government specifications stipulate that all plumbing fixtures be protected against the possibility of back-syphonage by either an air gap, where practicable, or by an approved vacuum breaker.

Sloan Valve Company pioneered the development of vacuum breakers and was first to gain approval from the National Plumbing Laboratory which formerly tested such devices. Sloan Vacuum Breakers, sensitive to the slightest vacuum, incorporate double protection to prevent back-syphonage as follows:

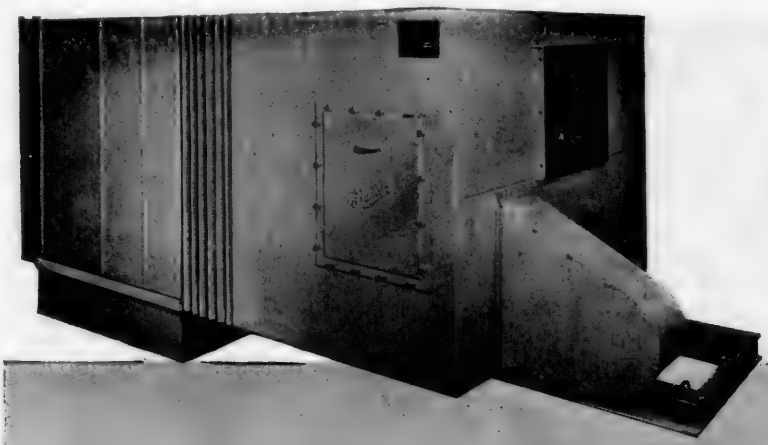
> When a vacuum occurs in the supply line (as indicated in Fig. 2), two things happen simultaneously. The swinging check instantly seats against the water port to prevent back-syphonage; and, as it swings, it opens the air port, admitting full atmospheric pressure to the fixture, which again prevents back-syphonage.

This superior vacuum breaker represents another achievement of Sloan engineering, constantly employed to assure outstanding products through research. It is one more example of that bonus of quality you expect from Sloan. And, since you can have Sloan quality at no extra cost, why not make sure you get it.



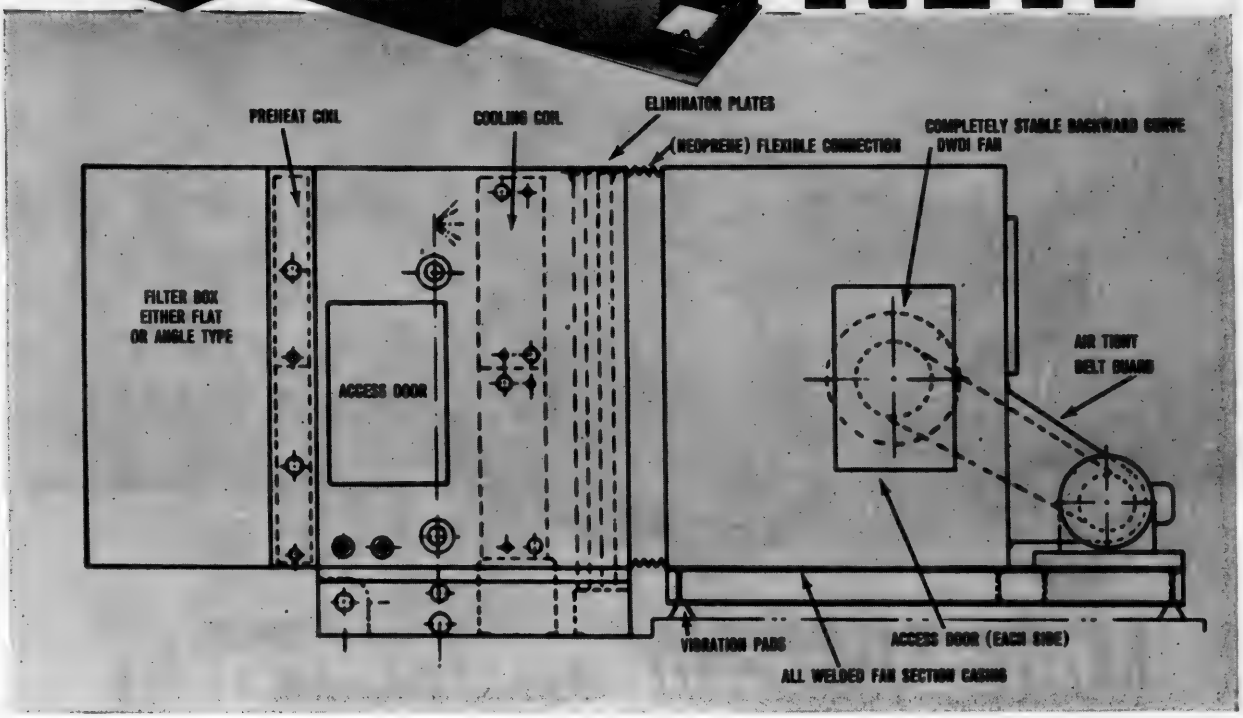
SLOAN FLUSH VALVES

SLOAN VALVE COMPANY • 4300 WEST LAKE STREET • CHICAGO 24, ILLINOIS



INCREASED EFFICIENCY IN
MORE COMPACT SIZE

NEW



"BUFFALO" HIGH PRESSURE AIR CONDITIONING CABINETS

- **A Complete Package — Buffalo "Q" Factor Construction throughout.**

Especially designed for high humidity installations such as hospital operating rooms and laboratories . . . this unit is ideal for high pressure systems (4" to 8" water gauge). It serves as a standard central station cabinet . . . and equally important acts as an air washer, with the functions of washing, air cleaning, humidifying and evaporative cooling.

Compact size is a big advantage. Unique new design reduces cabinet, ducts and grills. Evaporative cooling by recirculated spray water minimizes operation of mechanical refrigeration equipment during marginal weather.

"Buffalo" Quality Design and Construction Features:

- All-welded heavy gauge casing with 1" internal insulation.
- Completely stable backward-curved double width, double inlet fan (a "Buffalo" exclusive).
- Special air-tight belt guard.
- All components mounted on sturdy structural steel base.
- Among many accessories is an exclusive matched sound attenuator.

It's easy to get complete facts on these new High Pressure Air Conditioning Cabinets. Call your "Buffalo" Engineering Representative. Or write direct for Bulletin AC-150.

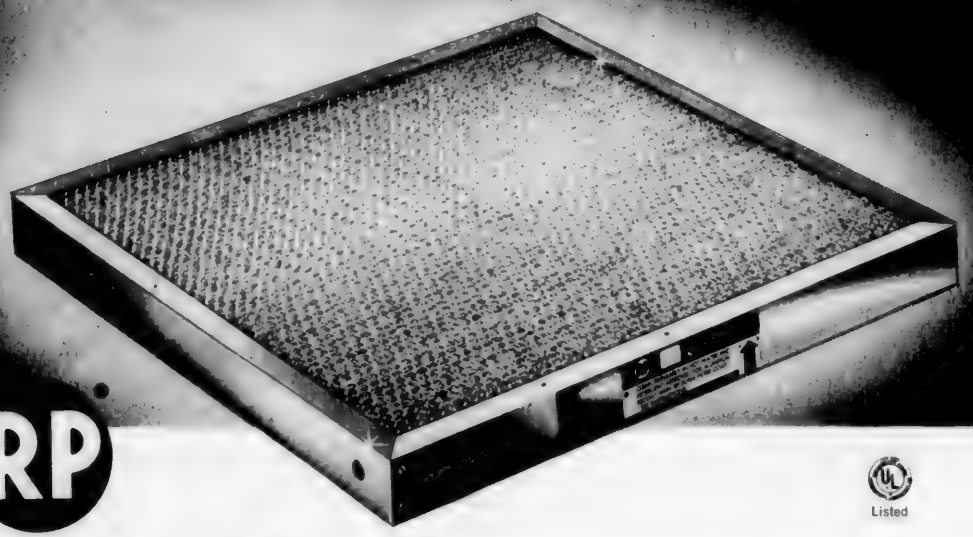
BUFFALO FORGE COMPANY BUFFALO, NEW YORK

Buffalo Pumps Division, Buffalo, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

VENTILATING • AIR CLEANING • AIR TEMPERING • INDUCED DRAFT • EXHAUSTING • FORCED DRAFT • COOLING • HEATING • PRESSURE BLOWING

Gives You MORE, Costs You LESS Check all the FEATURES!*



RP

Listed

Multi-Velocity INDUSTRIAL AIR FILTER

FOR HEATING OR AIR CONDITIONING

✶ **ALUMINUM** construction...rust-proof...corrosion-resistant. Eliminates need for expensive, heavy structural design in filter bank construction.

✶ **EASY TO HANDLE** Light-weight permits carrying, washing and installing of many more filters per hour.

✶ **EASY TO CLEAN** Lint and dirt are easily flushed off with water because of water soluble Super Filter Coat (the adhesive with the built-in detergent).

✶ **DEPTH LOADING** Designed to minimize surface loading, with depth loading accomplished through successive layers of slit and expanded aluminum, and varying baffle sizes.

✶ **REMOVES ODORS** Revolutionary R P Super Filter Coat adhesive adds odor removal to the normal dirt-trapping properties of R P Industrial Air Filters —with no increase in resistance—at *no* extra cost!

✶ **GERMICIDAL** Super Filter Coat adhesive contains Hexachlorophene, the well-known bacteria destroying agent.

✶ **LOWER RESISTANCE** Unique baffle design permits maximum air passage...more uniform dust collection within the filter depth.

✶ **HIGHER EFFICIENCY** Scientifically staggered pattern of flat baffles sets up a controlled turbulence that centrifuges dust and odor particles onto the adhesive for maximum efficiency.

for information, write RP / *Products of Research*

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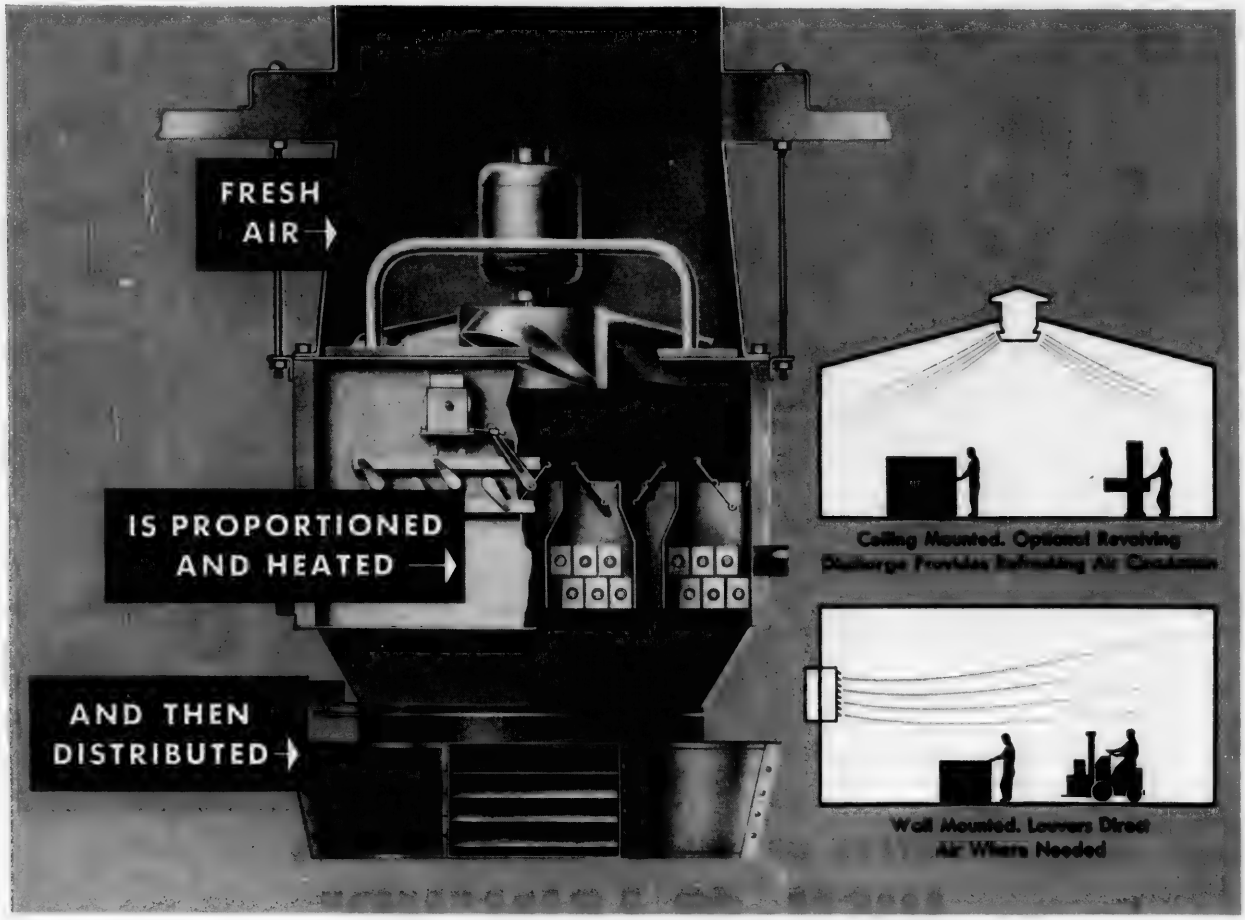

FRESH AIR
IS PROPORTIONED AND HEATED
AND THEN DISTRIBUTED
Ceiling Mounted. Optional Revolving
Wall Mounted. Louvers Direct Air Where Needed

• Exhaust systems function better
• Workers are more efficient
with Wing Fresh Air Supply Heaters

Wing FAS Heaters offer three big advantages to plant operators:

1. They supply make-up air to compensate for air expelled through exhaust systems, and thereby improve the operation of the exhaust systems.

2. By providing slightly positive air pressures in the building, drafts and cold air leaks are eliminated — workers are comfortable.

3. When used to provide comfort ventilation, they help improve workers' efficiency and health.

Wing Fresh Air Supply Heaters provide constant air intake while automatically maintaining desired discharge temperatures. Usually, air is discharged at room temperatures and is directed above the workers' heads so that comfort is undisturbed.

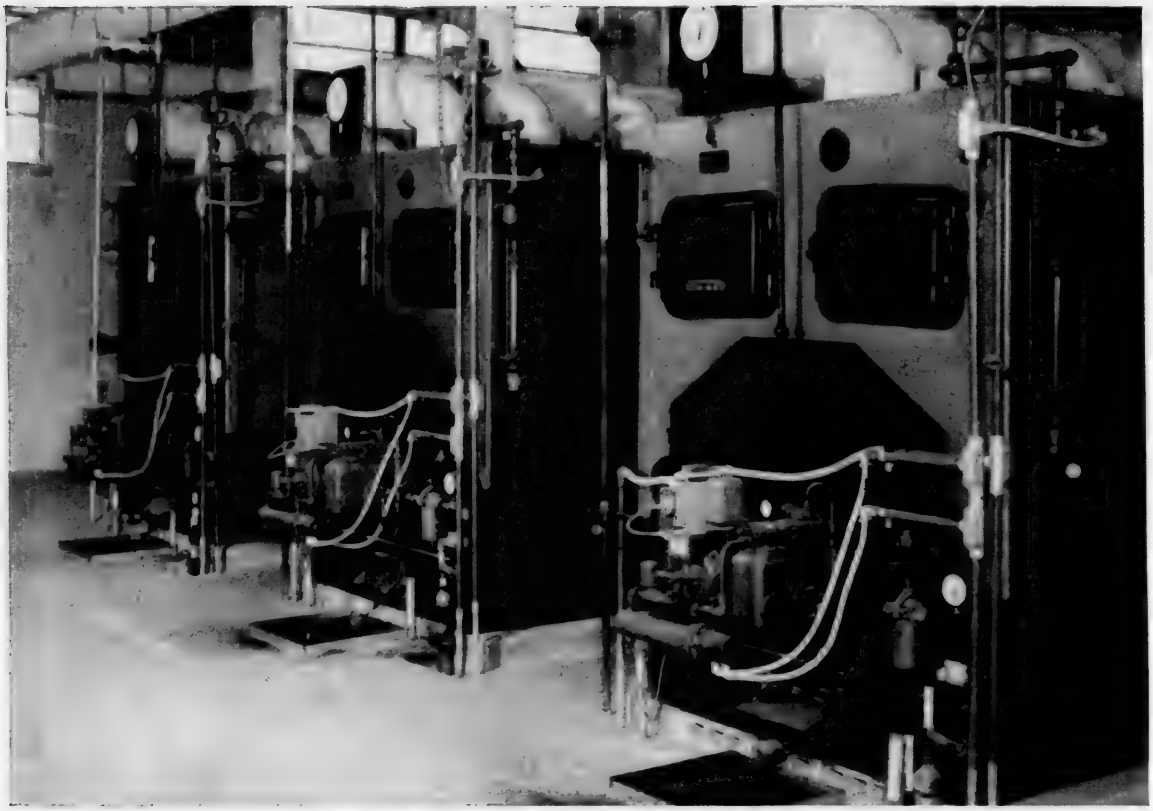
The FAS Heater shown above operates with steam or hot water. Coils cannot freeze. Direct-fired gas units are also available. All can be provided for wall or ceiling mounting in a full range of capacities. A variety of revolving or fixed discharges meet any mounting height requirement. Also suited for use in fog elimination installations.

Send for literature describing construction and giving application information.

WC131

L. J. WING MFG. CO.
DIVISION OF AERO SUPPLY MFG. CO., INC.
140 VREELAND MILLS ROAD, LINDEN, NEW JERSEY
FACTORIES: LINDEN, N. J. AND MONTREAL, CANADA

WING



SISTERS OF MERCY CONVENT SELECTS

WEIL-McLAIN "HR"

CAST IRON HEAVY DUTY BOILERS FOR HORIZONTAL ROTARY OIL BURNERS

General Motherhouse, Sisters of Mercy of the Union, Bethesda, Maryland

ARCHITECTS-ENGINEERS: Maguolo and Quick, Baltimore, Md.

MECHANICAL ENGINEER: William U. Thompson, Baltimore, Md.

CONTRACTOR: Harry E. Nau & Co., Baltimore, Md.

DISTRIBUTOR: United Plumbing & Heating Supply Co., Washington, D.C.

The three Weil-McLain "HR" Boilers illustrated here develop a total of 315 HP and are designed specifically to achieve the economies possible with horizontal rotary oil burners using low-cost heavy oils. Among the many features which dictated their selection are:

1. Steel front plate simplifies installation of rotary burner.
2. High base makes more combustion space available —eliminates high brick foundation.
3. Large firebox volume develops better combustion conditions and maximum radiant heat transmission.
4. Curved primary heating surface extends from crown sheet, greatly increasing area directly above fire.
5. Balanced gas travel through the flueways assures equal distribution of heat to all secondary heating surfaces.
6. Generous waterways permit rapid water circulation.
7. Large steam space assures rapid generation of dry steam.
8. Rugged cast iron construction for durability.
9. Individual short draw rods simplify assembly and contribute to longer boiler life.

Send for Bulletin C-188. For other Weil-McLain Gas and Oil Boilers, see Engineers' Product File or Sweet's Architectural File.

WEIL-McLAIN
BOILERS · RADIATORS

WEIL-McLAIN COMPANY
MICHIGAN CITY, INDIANA

Address literature requests to Dept. BB-20

HEADROOM PROBLEMS

are but one of many reasons why leading gas companies now recommend a

for commercial-industrial GAS equipment

Proven in thousands of gas installations, Field does everything a draft diverter does—AND MORE—offering new simplicity, new flexibility, new precision in the control of draft.

If you design, specify, install or approve gas-fired equipment consult Field engineers for draft control recommendations.

Here's how Field helps make GAS an even finer fuel:

1 — **COMPACT SIZE: Field** is small, compact, can be placed in a variety of approved locations. Limited headroom no longer presents a draft problem.

2 — **DRAFT ASSISTANCE:** With **Field** you can utilize the draft assistance of the chimney, with settings as low as .002", as high as .35." Draft-short installations are avoided.

3 — **LOAD FLEXIBILITY:** With a **Field** firing rates can be varied — increased for increased loads, or decreased, and without loss of efficiency. Now gas is an even more flexible fuel.

4 — **REDUCED CONVERSION COST:** With a **Field** no change in breeching area is required when converting from coal or oil. Now it is quicker, simpler, less costly to convert to gas.

5 — **REDUCED "START-UP" SPILLAGE:** By avoiding loss of chimney prime, permitted with a diverter, **Field** minimizes the spillage caused by cold stack resistance.

6 — **AUTOMATIC CONTROL: Field** not only gives visual evidence of any spillage, but, when switch-equipped, spillage will automatically actuate virtually any response an engineer may specify. Thus **Field** permits still another refinement in the industry's meticulous handling of its fuel.

FIELD CONTROL DIVISION

Conco Engineering Works, Inc. — Mendota, Illinois

AFFILIATES:

Spartan Tool Division — Powered Sewer Cleaning Equipment
Material Handling Division — Cranes, Hoists
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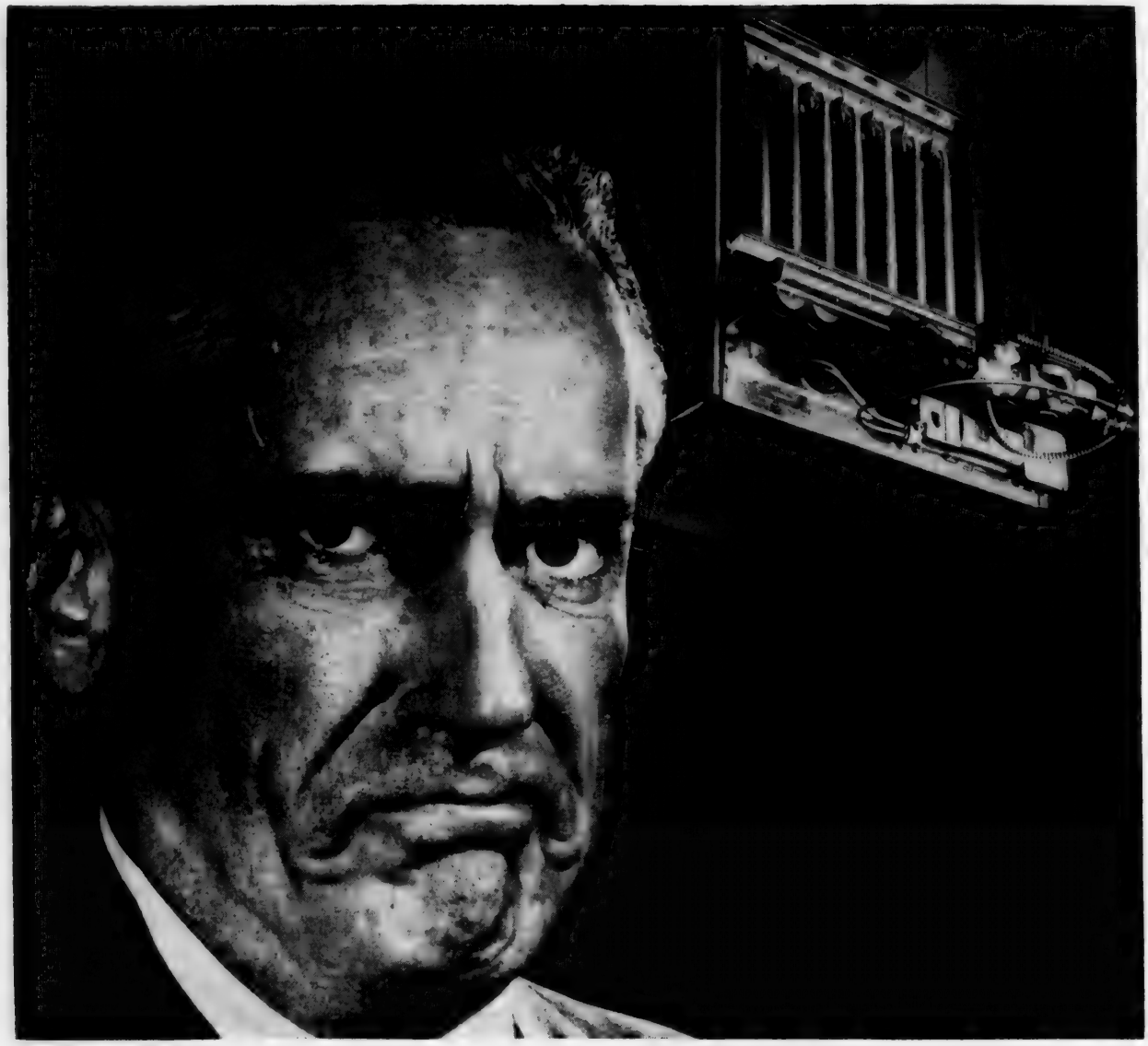
field



TOUGH BUYERS

DEMAND REZNOR STAINLESS STEEL DUCT FURNACES

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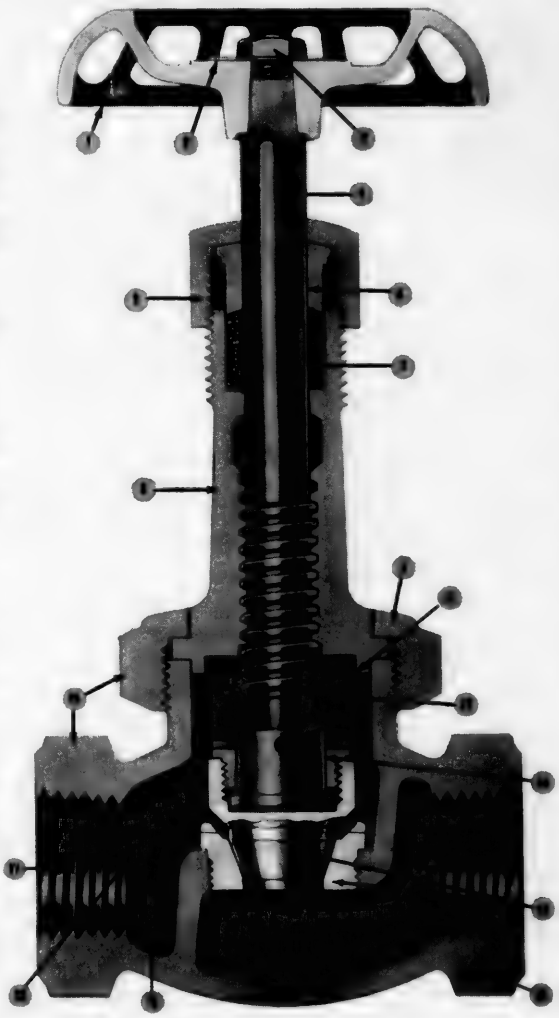

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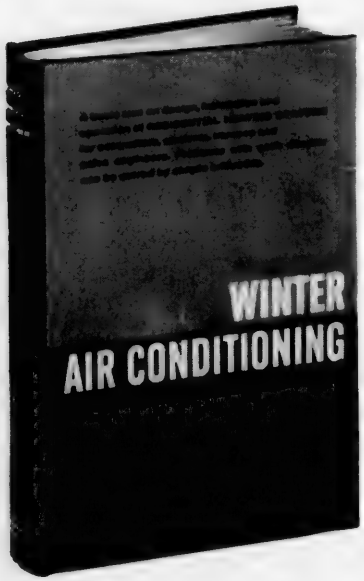

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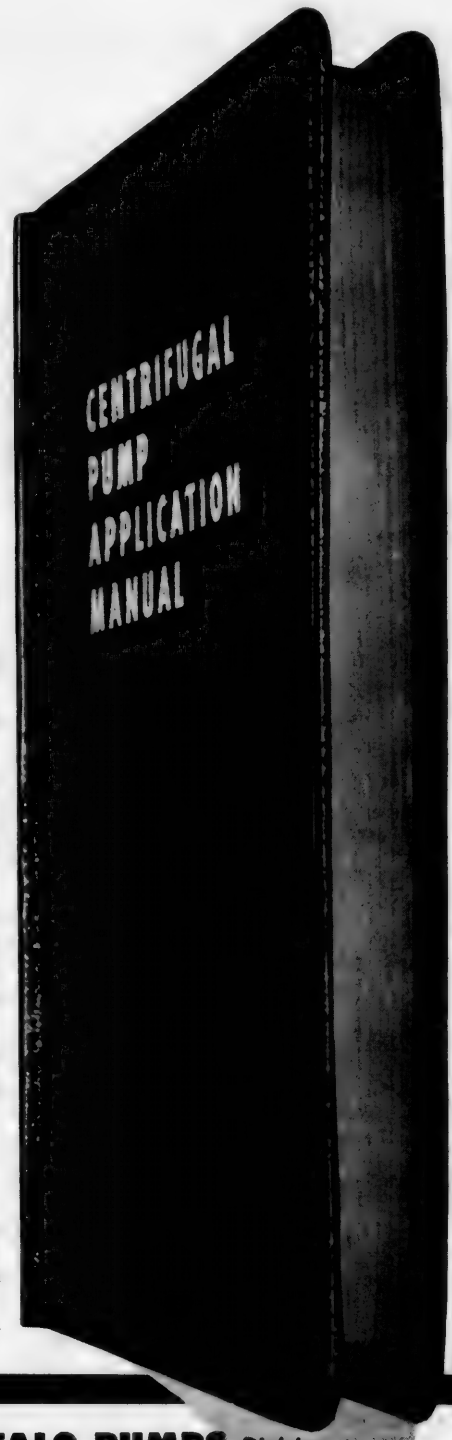

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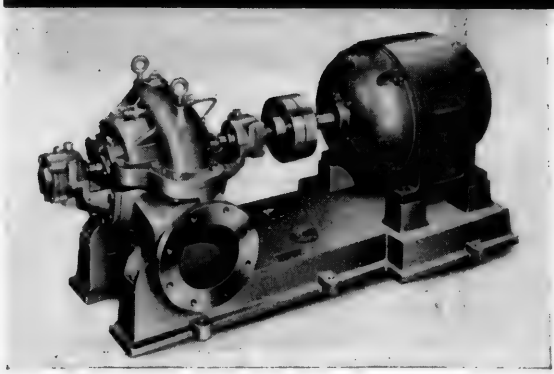

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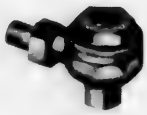

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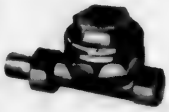
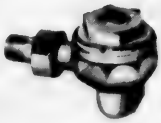


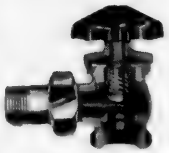
STRAIGHTWAY PATTERN

VERTICAL PATTERN

LEFT HAND CORNER PATTERN



RIGHT HAND CORNER PATTERN



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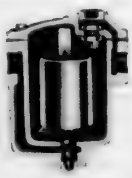

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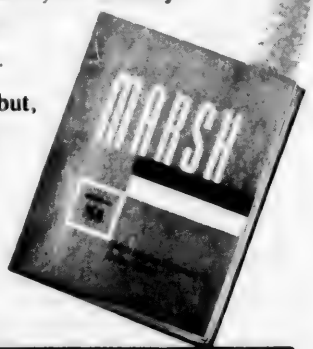

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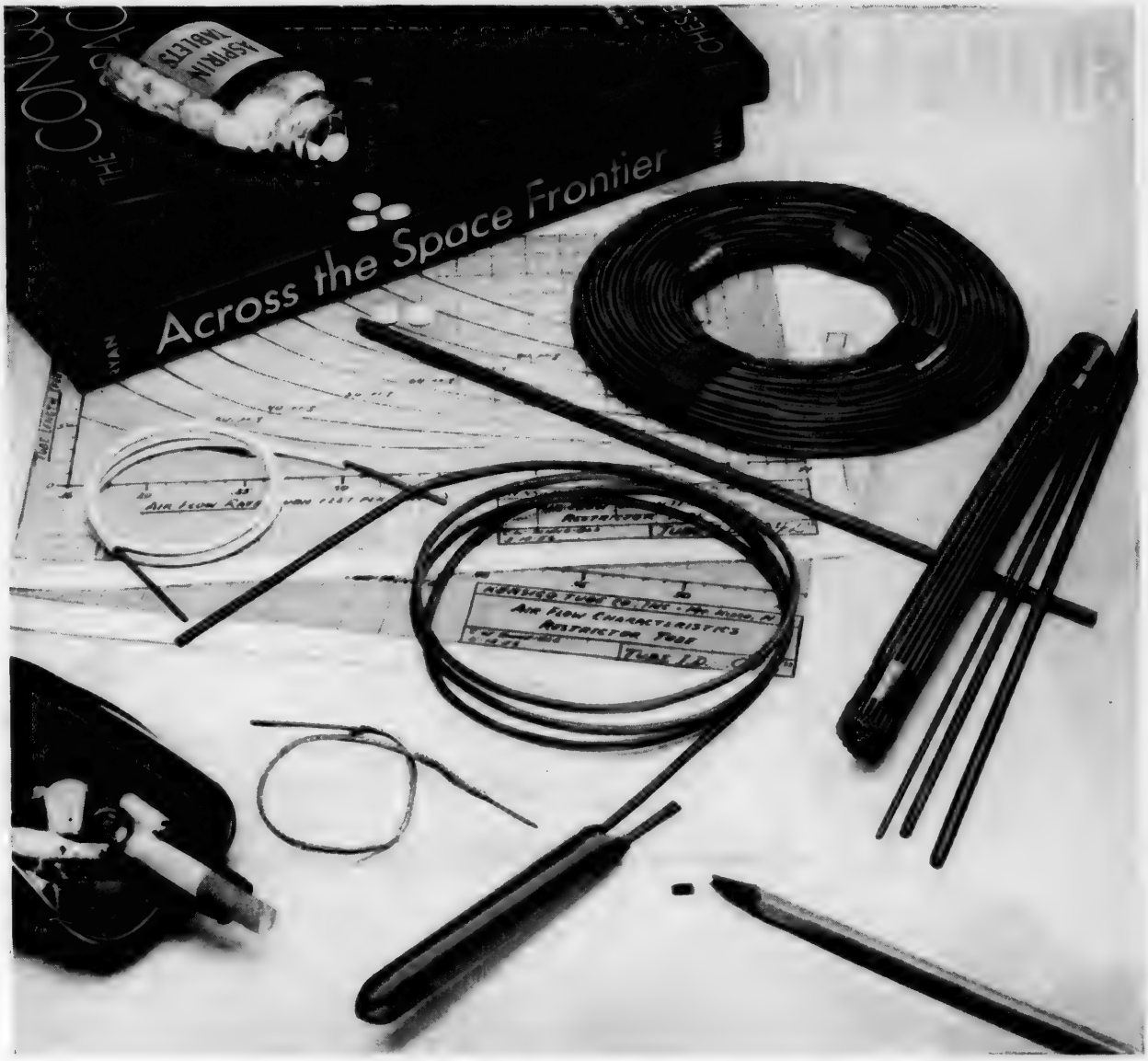

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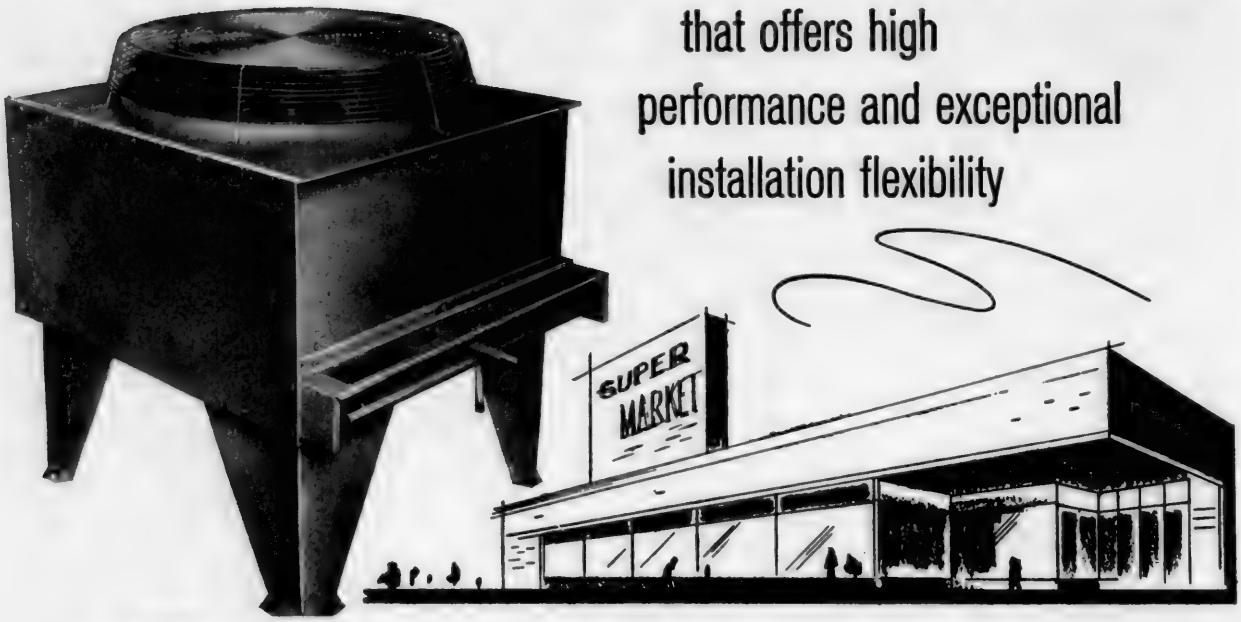

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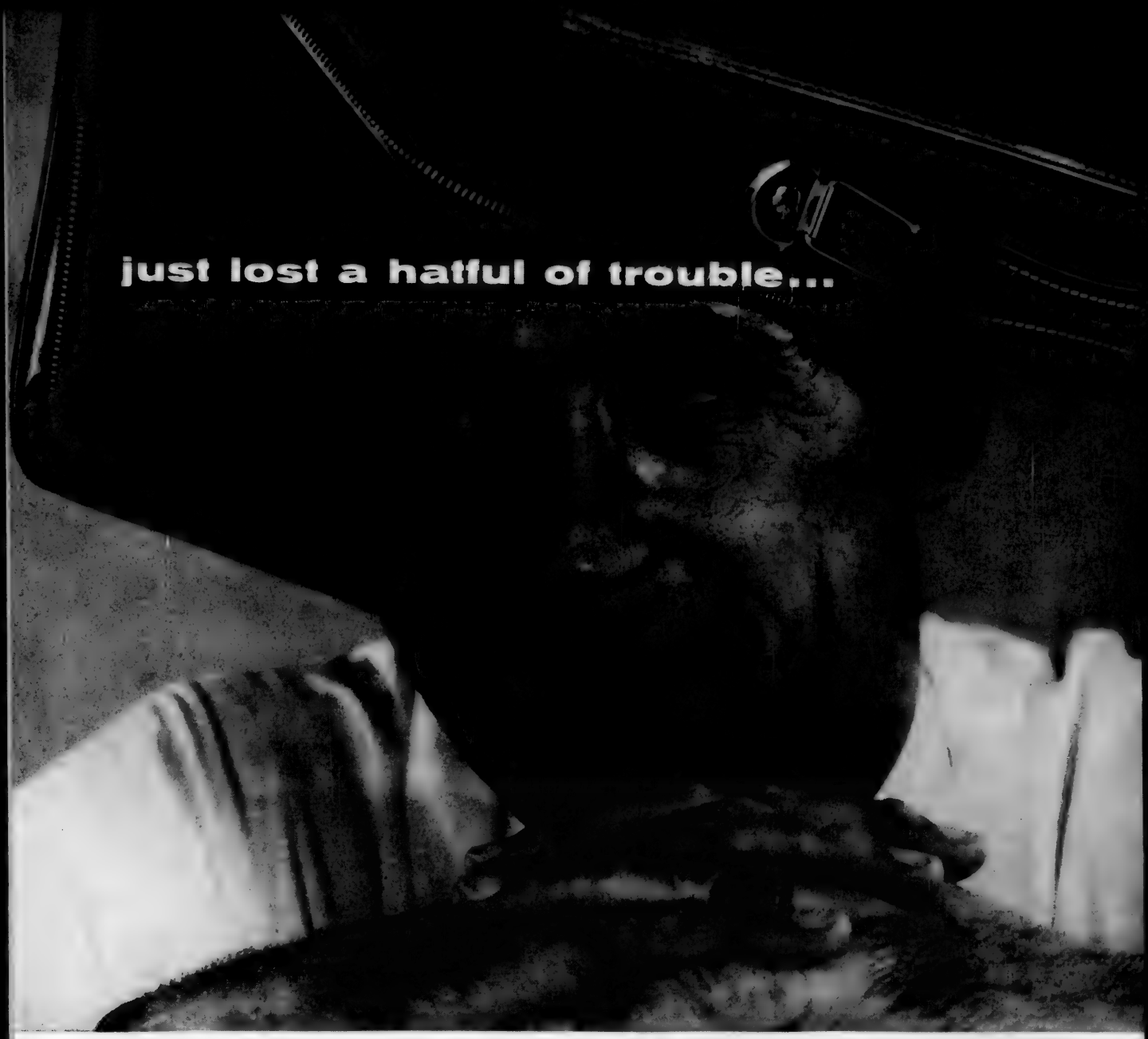

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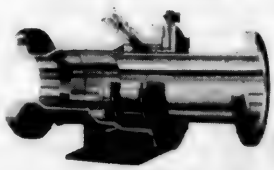

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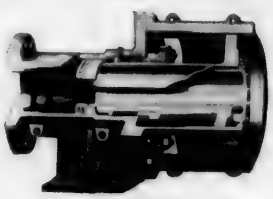

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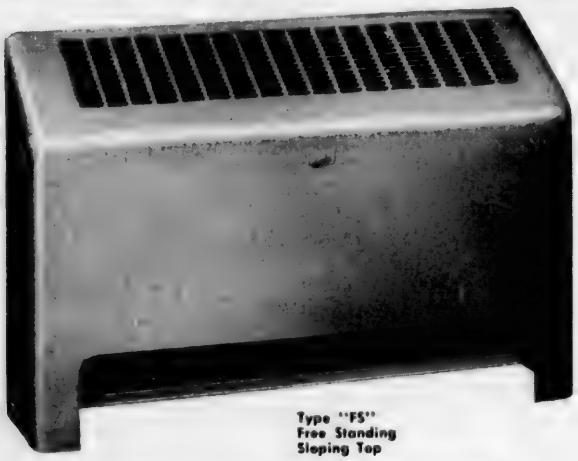

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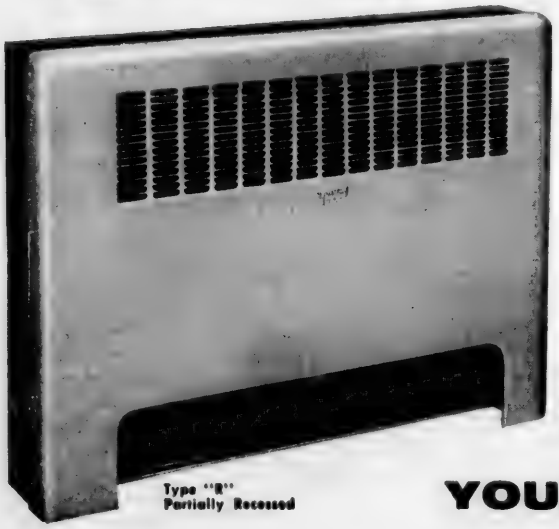

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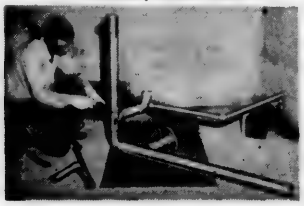

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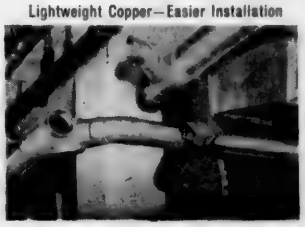

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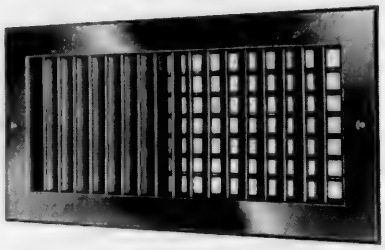

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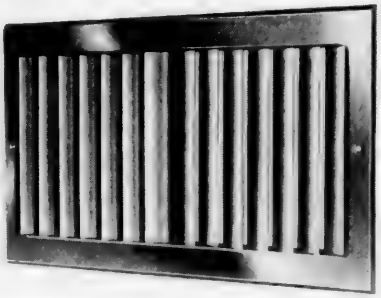

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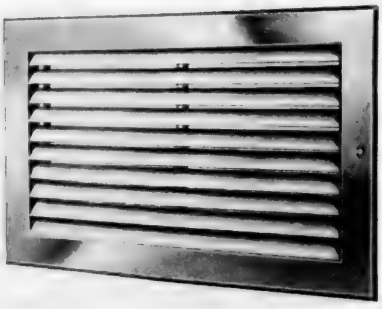

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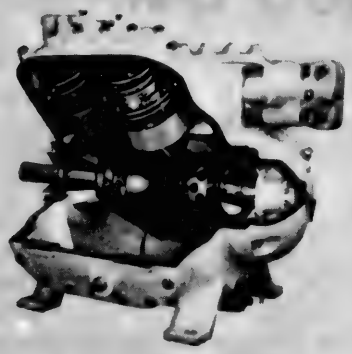

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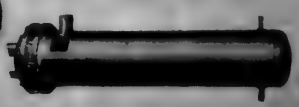

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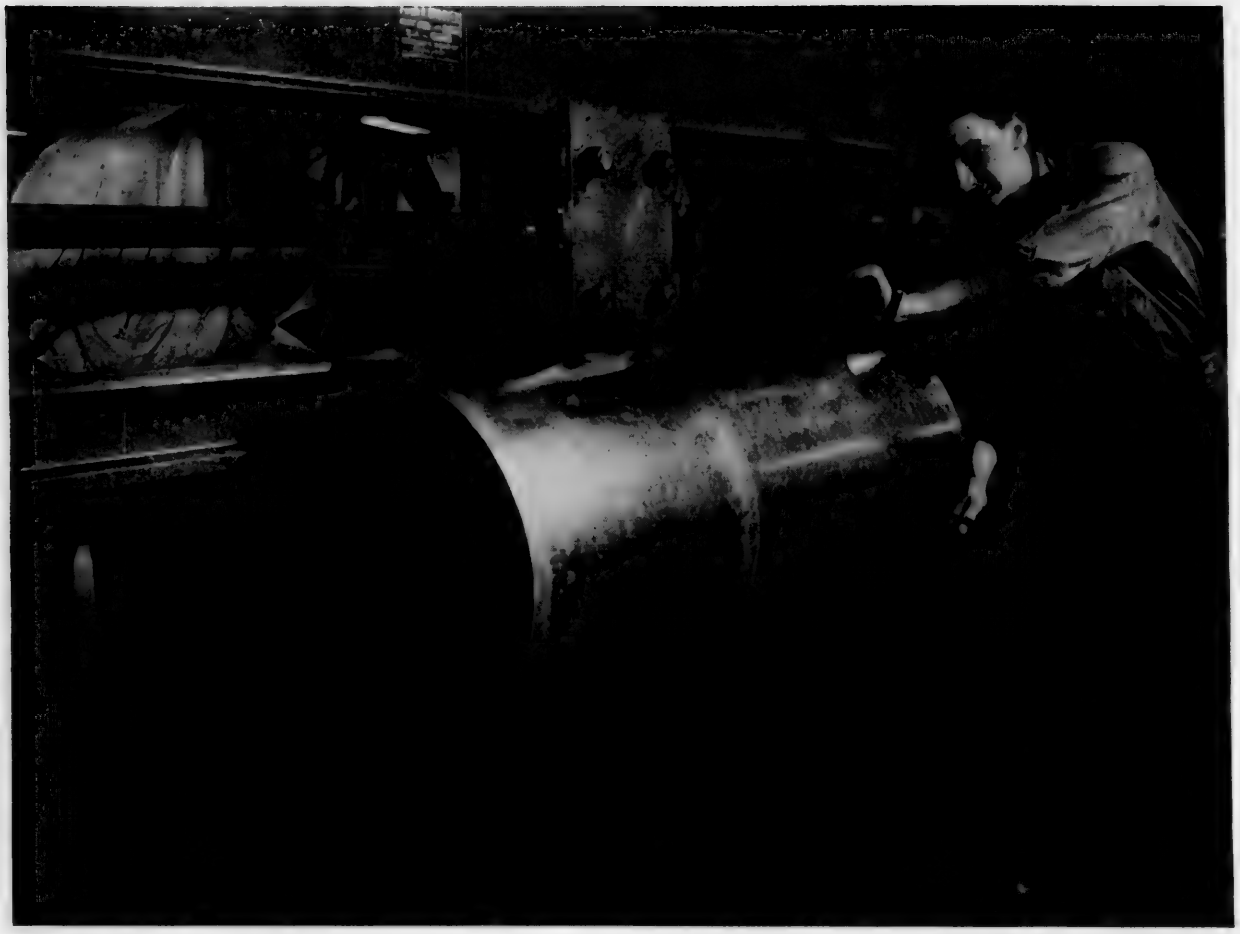
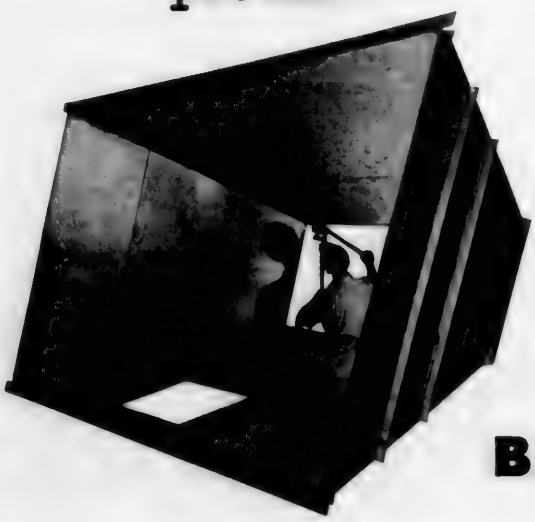


Bethcon Galvanized Steel

forms easily, builds strong product



When you flex a piece of Bethcon galvanized sheet steel, you notice it has a certain extra "something." Liveliness, if you will. Toughness, perhaps. Or strength with ductility. Whatever you might call it, Bethcon is a sheet that forms up easily, builds a strong end product.

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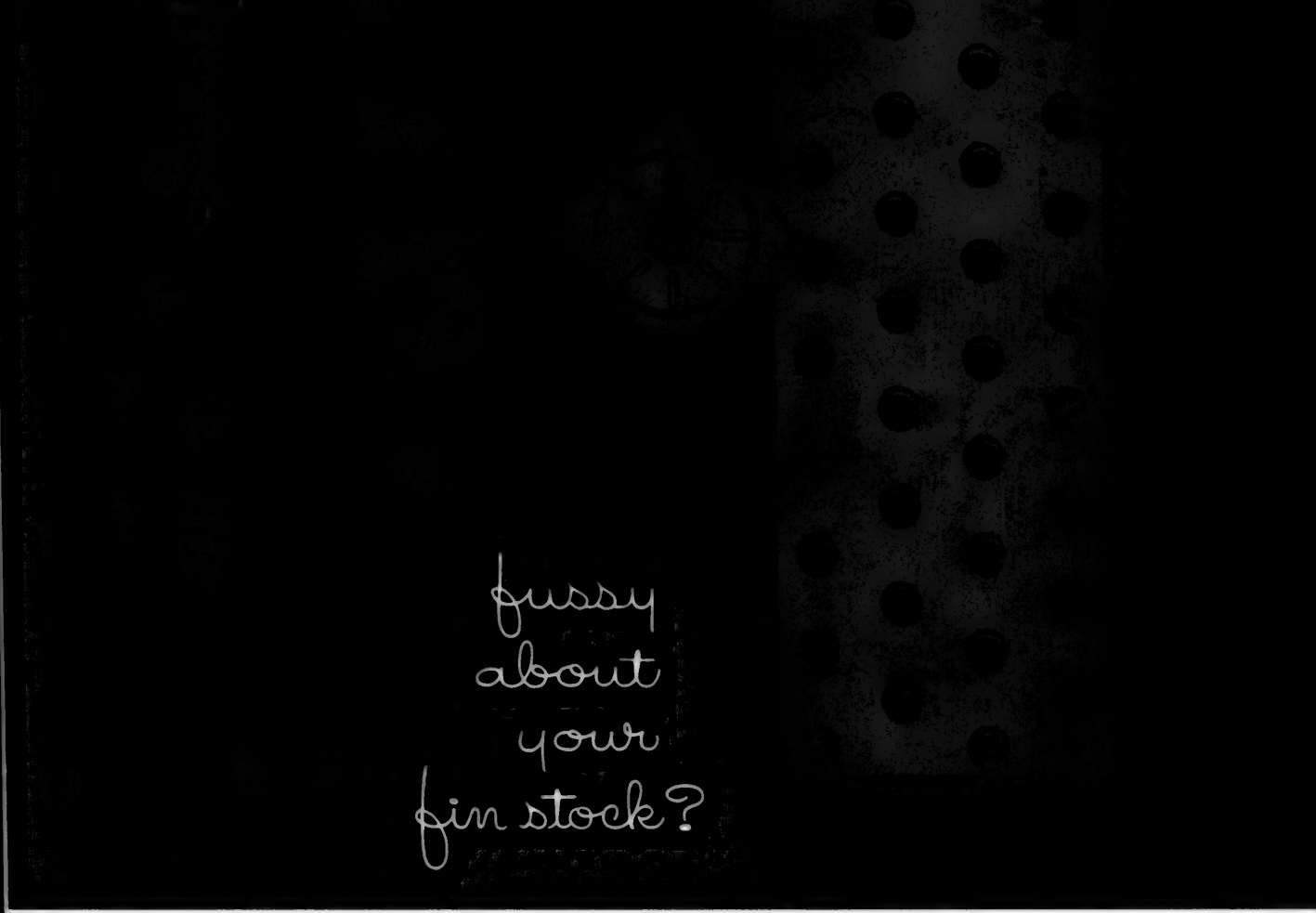

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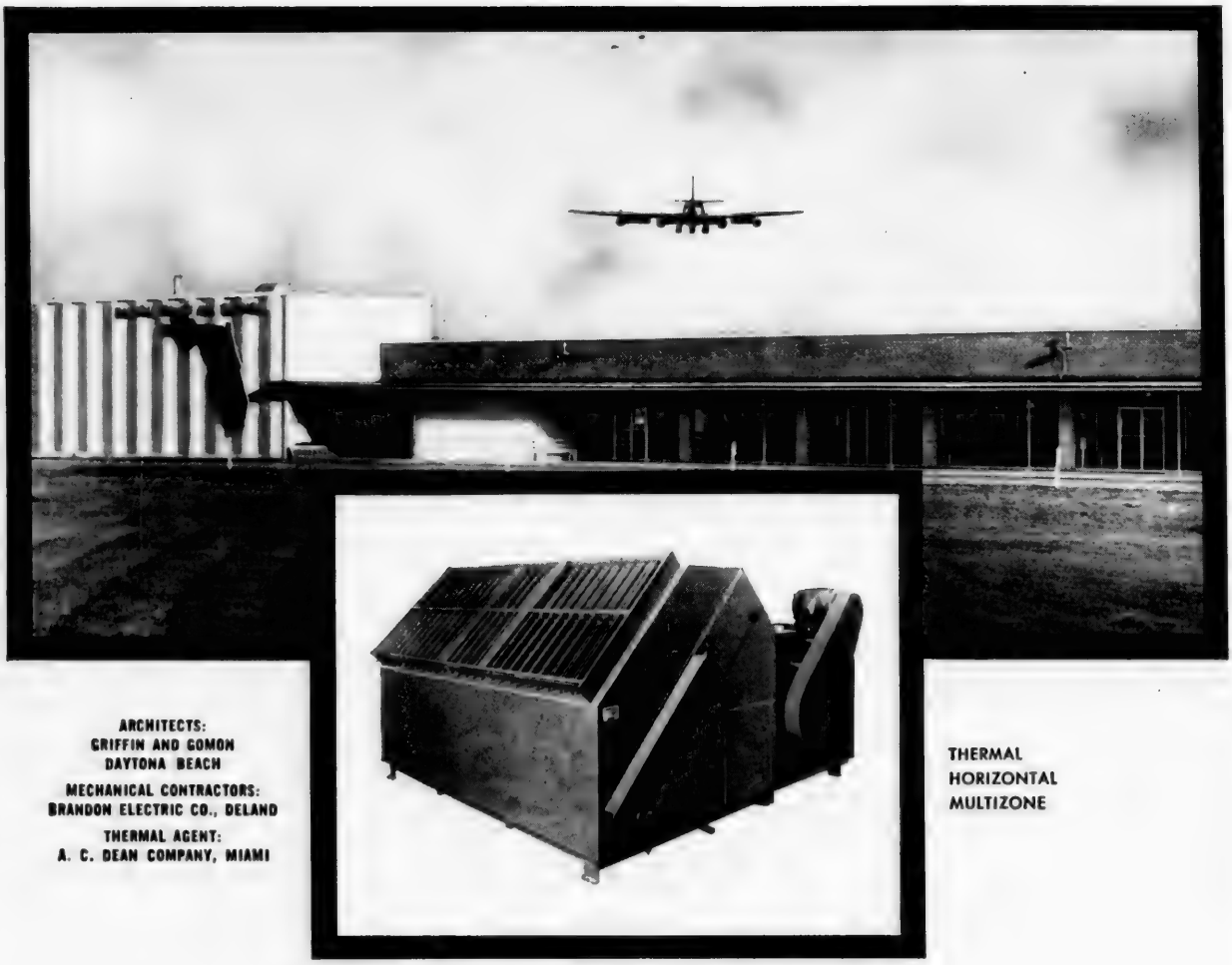

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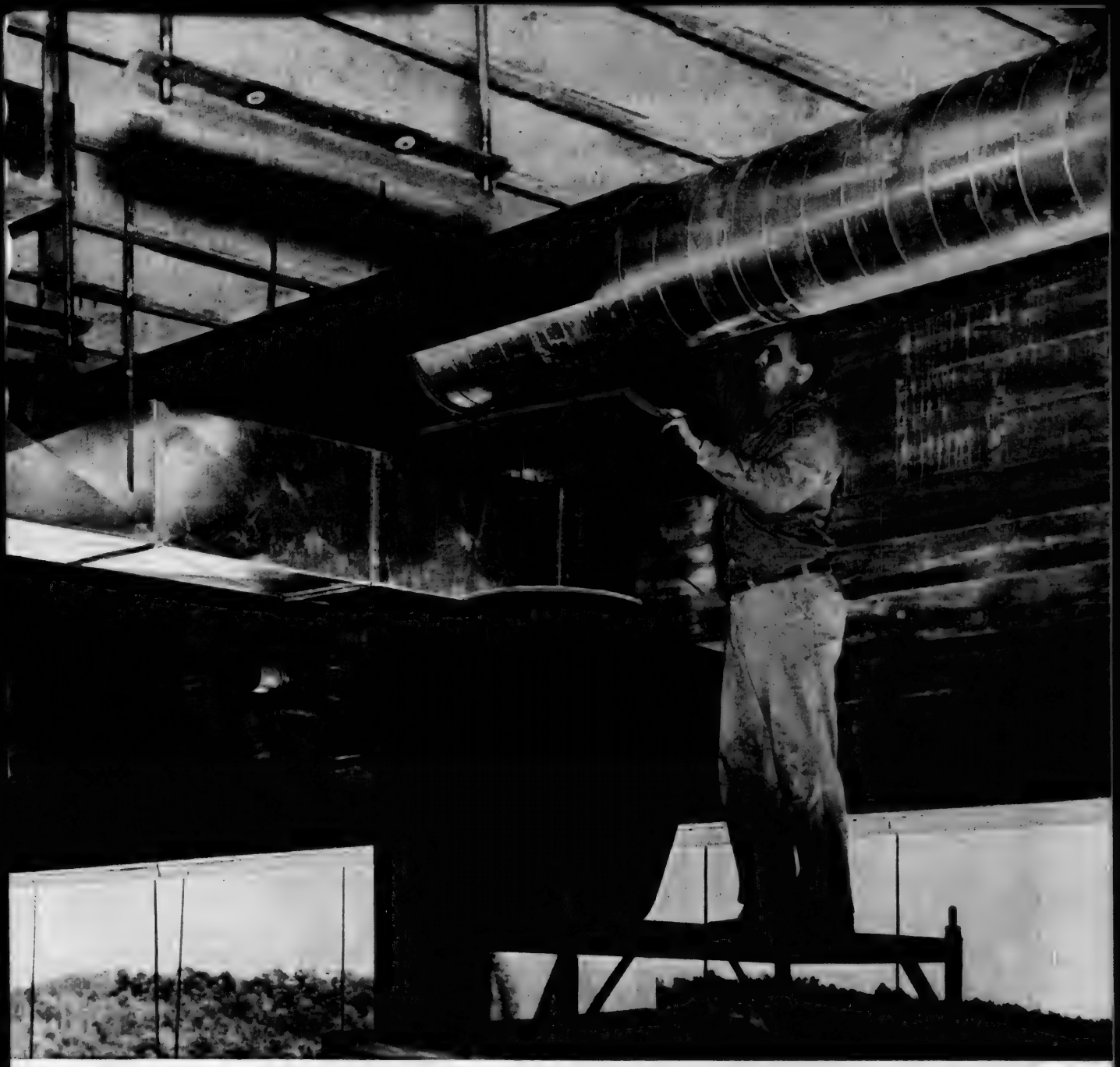

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Photo by Ezra Stoller

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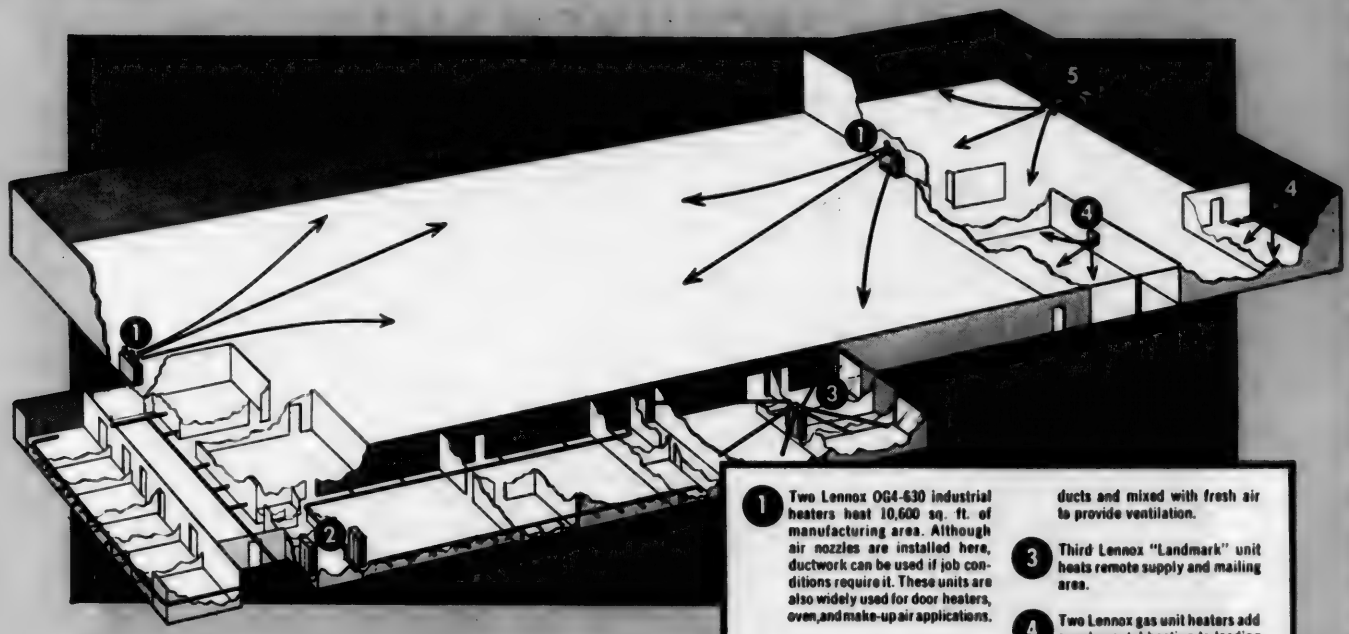
JOHNS-MANVILLE JM PRODUCTS

HOW *LENNOX* SOLVES INDUSTRY'S HEATING PROBLEMS



1. Two Lennox OG4-630 industrial heaters heat 10,600 sq. ft. of manufacturing area. Although air nozzles are installed here, ductwork can be used if job conditions require it. These units are also widely used for door heaters, oven, and make-up air applications.
2. Two Lennox "Landmark" heating-cooling units maintain year 'round comfort in 4,800 sq. ft. office area. Supply ducts are located in concrete slab with outlets at perimeter. Return air is brought back through overhead ducts and mixed with fresh air to provide ventilation.
3. Third Lennox "Landmark" unit heats remote supply and mailing area.
4. Two Lennox gas unit heaters add supplemental heating to loading and storage areas.
5. Single Lennox gas duct heater with a Lennox packaged blower suspended from ceiling heats 7,200 sq. ft. Cooling may be added, if desired.

ECONOMICAL HEATING IN SEPARATE PLANT, WAREHOUSE AND OFFICE AREAS

There's no guesswork or "make do" with Lennox equipment . . . this broad line of industrial units meets every heating requirement. In the New York plant shown here, for instance, several types of heating problems faced the engineers. Each area in the plant had its own heating peculiarities and needs, and by utilizing several types of Lennox models, each problem was *easily* solved. The result: properly sized heating units that deliver top heating comfort at a sensible cost. If you have a heating and/or cooling problem, mail the attached coupon today. See how Lennox can *help you* with the solution.

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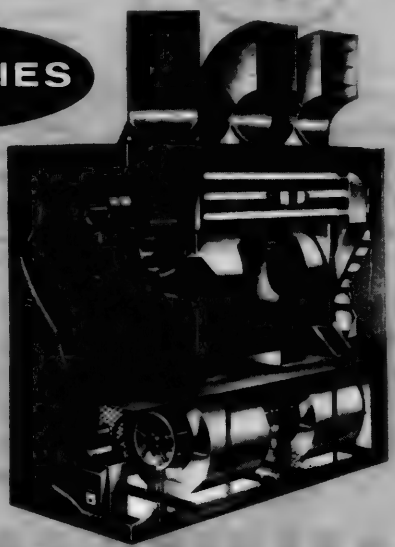
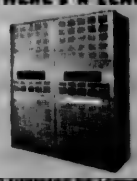


The "big boy" of the Lennox line. Can be used as a central furnace with ducts, or as a unit heater. Installation may be horizontal, vertical, suspended or floor mounted. A wide choice of blower motors and drives satisfy all air volume requirements. Burner is completely enclosed in sound proof compartment. 280,000 Btuh output and up.

THERE'S A LENNOX FOR EVERY INDUSTRIAL APPLICATION



LANDMARK BY LENNOX
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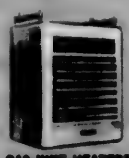

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Small capacity for small areas. Capacities range from 80,000 to 250,000 Btuh.

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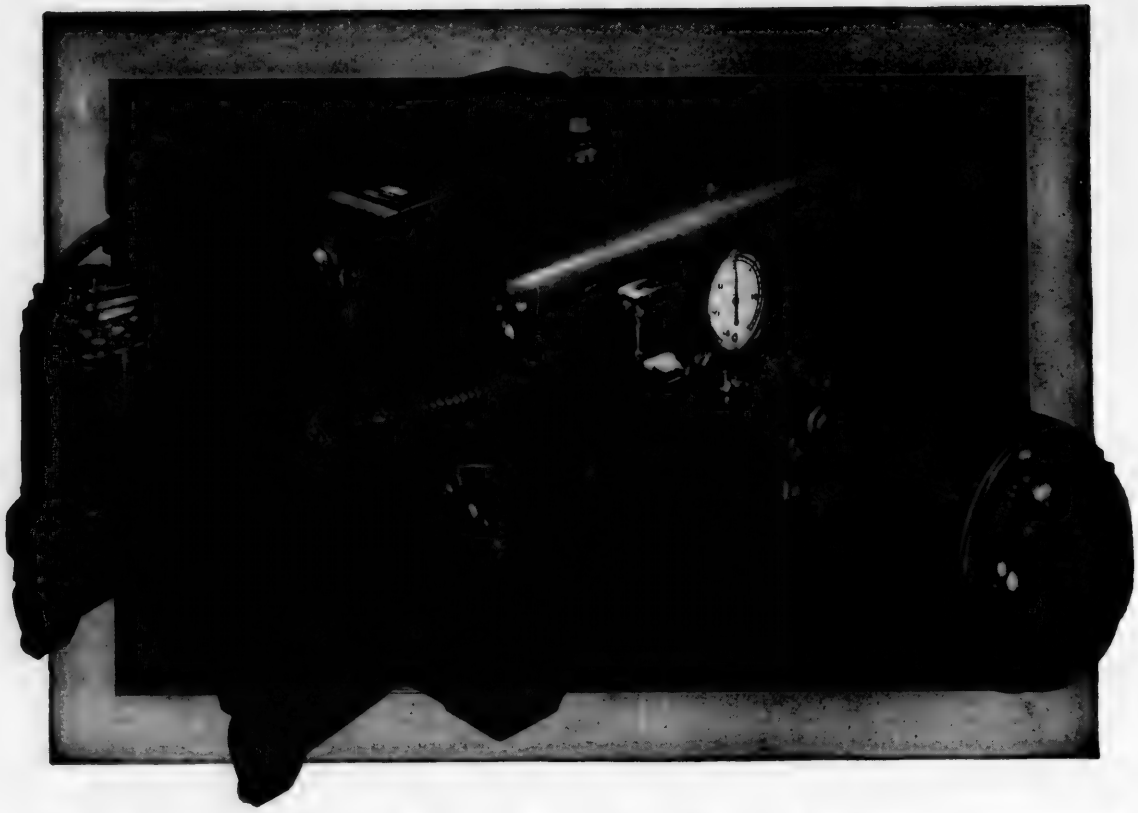

It's the Nash CSM

No longer is it necessary for the Engineer to accept a vacuum heating pump with air and water capacities based inflexibly upon square feet of equivalent direct radiation. With the flexible Nash CSM he can provide for proper air capacity in accordance with his judgment and experience. For the individual capacities of the separate pumps on the CSM may be varied within a wide range, without buying an oversize receiver and oversize water pumps.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low, returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

NASH ENGINEERING COMPANY
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In foreground are two 750,000-gal ground storage tanks adjacent to boiler house. Together with the 400,000-gal elevated tank, left rear, they provide ample water storage for domestic use and for fire protection at Chrysler Corporation's new St. Louis assembly plant. Article shows how . . .

Control System Guarantees Supply From Distant Water Mains

J. NACHBAR
Mechanical Engineer, Albert Kahn
Associated Architects & Engineers
Detroit, Mich.

IN recent years, in order to acquire the large tracts of land necessary for single-story plant construction, including utility buildings and adjoining parking lots, industry has had to locate at considerable distances from established water supply systems.

After selection of the site for Chrysler Corporation's new St. Louis assembly plant, arrangements had to be made with the St. Louis County Water Company to extend a new, several mile long, water supply main to the plant. Length of the main serving the plant, coupled with the fact that it is the only source of water available, makes the supply for domestic use and for fire protection quite vulnerable and subject to temporary interruptions.

To guarantee the plant an uninterrupted supply, provision for water storage on the site includes: a 400,000-gal elevated tank approximately 160 ft high to the overflow, and two 40-ft high surface storage tanks, each having a capacity of 750,000 gal. By means of suitable piping, 200,000 gal, in the elevated tank, and 250,000 gal, in each surface tank, are reserved for fire protection purposes.

Layout of Piping and Tanks

Water enters the plant site at its southeast corner (see schematic, page 63) where it is metered in an underground meter pit. In addition to meters, check valves serve to prevent loss of plant water in case of a break in the city main. A 12-inch main extends underground to the pipe enclosure under the elevated tank, where an altitude valve controls the filling of the tank through the fill riser.

The plant is supplied from the elevated tank through another altitude valve in a separate riser and by means of a water main extending underground to the assembly building, where the main rises into the truss space. A water loop is formed in the truss space with branches extending to points of demand. Separate water lines are taken off the loop and extended underground to outlying auxiliary buildings and to the boiler house. In addition, an 8-inch line is extended underground from the assembly building to the surface tanks. This line enters the pit under the tanks and fills the tanks through a single way altitude valve. In operation, this valve opens to fill the tanks with water and closes when the tanks are full. The valve may be closed, also, from a remote location as described below.

The surface tanks, also called ground suction tanks, supply water to the suction side of two 1000-gpm pumps

located in the boiler house. These pumps serve a dual purpose: (1) They supply the plant with water in case of an interruption in the city water supply, and (2) they are used for refreshing the water in the ground suction tanks.

Operating Cycles

The plant water supply may be operated on the following two cycles, at the discretion of the operator: (1) The *normal cycle*, and (2) the *pumping cycle*. During the normal cycle, city water from the meter pit fills the elevated tank through a single acting (one-way) altitude valve. This valve closes automatically when water in the tank has reached the overflow level. Once closed, the valve will not open until plant usage has lowered the water level in the tank to an elevation of 5 ft below the overflow. At this point, the valve will open and the tank's water supply will be replenished from the city main.

In case of a break in the city supply system, or whenever conditions dictate refreshing the water in the ground suction tanks, the operator, stationed in the boiler house, can throw the system into the pumping cycle by positioning the cycle selector switch to permit the automatic operation of the domestic water pumps. These pumps are controlled by the level of water in the elevated tank. With the elevated tank full, no pump will operate. When the water in the tank has dropped, however, to an elevation of 2 ft below the overflow, the pump will start automatically. It will take suction from the ground suction tanks, supply the plant demands, and fill the elevated tank through the double acting (two-way) altitude valve located at the base of the tank, which serves as a surge tank for the system. Water reaching the overflow level in the elevated tank will automatically stop the pump.

Throwing the system into the pumping cycle permits the automatic operation of the pumps, as required, and automatically closes the altitude valve in the fill line to the ground suction tanks. This altitude valve remains closed as long as the plant water supply system operates in the pumping cycle, thus permitting the lowering of the water in the tanks to the desired level. At the same time, the water is not permitted to re-enter the tanks through the fill line.

Suction Tank Water Always Fresh

After the water in the ground suction tank, or tanks, has been lowered to the desired level, the operator will move the cycle selector switch to the normal position. This will automatically prevent operation of the pumps and simultaneously open the altitude valve in the fill line to the ground suction tanks, thus refilling the tanks. By means of an electrical interconnection, the opening of this altitude valve will automatically actuate the pressure reducing valve in the by-pass between the incoming and outgoing lines at the elevated tank. The pressure reducing valve is required because of the high city water pressure, expected to vary from 110 to 150 psi. The valve is set to deliver down-stream pressure 5 psi above the static pressure of the full elevated tank. In this way, whenever the pressure reducing valve is in operation, water to supply the plant flows from the city main and not from the elevated tank. Inasmuch as the opening of the altitude valve at the ground suction tanks causes the pressure reducing valve at the elevated tank to operate, the ground suction tanks are always filled with fresh city water.

The function of the double acting (two-way) altitude valve in the line from the elevated tank to the plant is to prevent the tank from overflowing when the pumps are operating. Should the pressure reducing valve be put in operation while the elevated tank is partly down, the tank would be filled through the double acting altitude valve, with the valve closing after the tank has been filled.

The automatic controls have been designed to sense the changes and conditions in the water supply system; to transmit the information to the proper control components, which in turn operate the desired valves, pumps, etc.; and to serve as a means of keeping the operator stationed in the boiler house informed at all times as to the status of the system.

What the Controls Do

The controls (1) fill all storage tanks automatically; (2) operate pumps automatically according to the level of water in the elevated tank; (3) remotely indicate and record water levels and temperatures in the tanks; (4) register alarms for the low level and temperature conditions in the tanks, with the required pump interlocks; (5) indicate the operation of pumps and associated hydraulic check valves; (6) register alarms to indicate loss of electric power at individual control units; (7) indicate by means of alarms low water pressure in the fire protection system; (8) meter and record water usage in the boiler house; (9) indicate positions of certain remote valves, and other minor functions of the control system.

The following four control cabinets are part of the system:

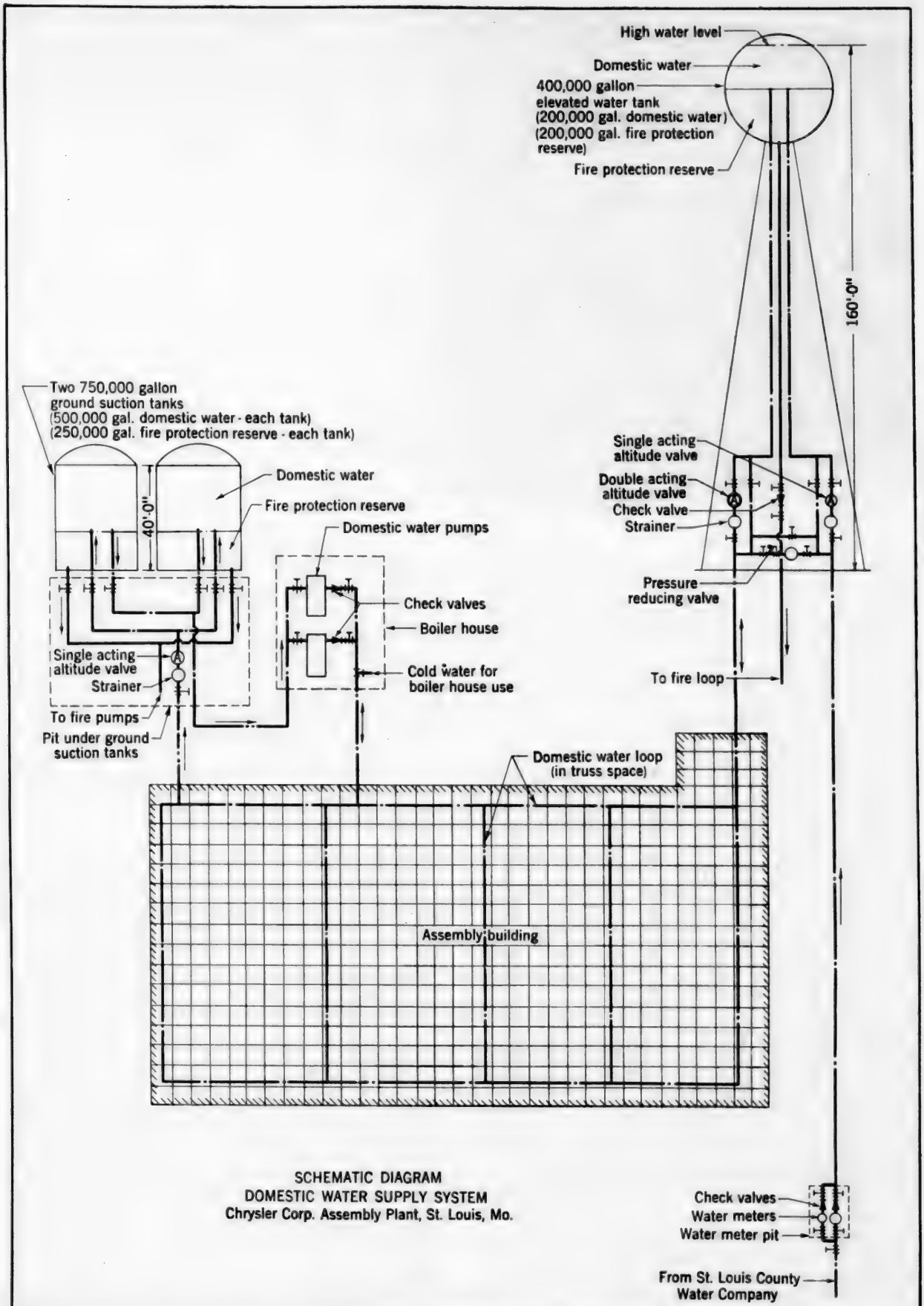
1. Transmitter located at base of elevated tank;
2. Transmitter located at ground suction tanks;
3. Pump controller located near pumps in boiler house; and
4. Monitor board also located in boiler house.

All four cabinets are inter-connected electrically. The monitor, among other functions, serves as an electrical junction point for the control wiring of the system.

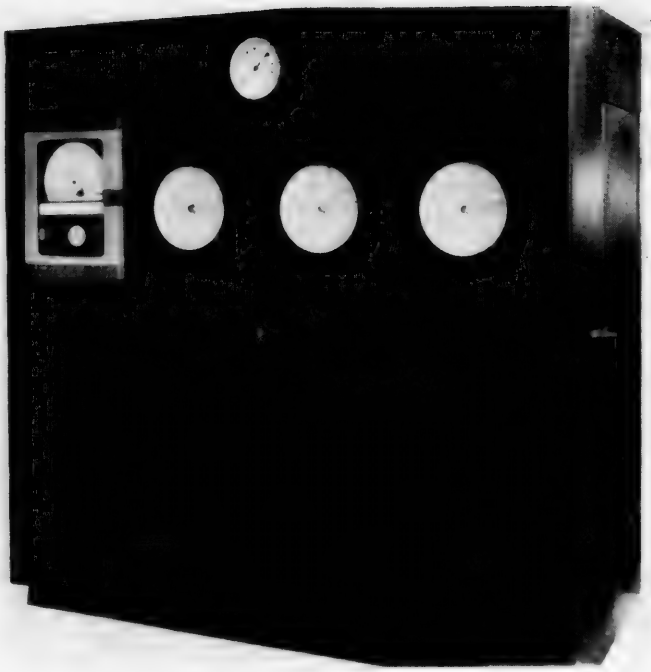
Control System Details

A static pressure line is brought down from the elevated tank into the transmitter at the base of the tank where it connects to pressure sensing bellows equipped with mercury switches. The pressure in the bellows reflects the elevation of the water in the tank. The mercury switches, set to operate at different levels, actuate relays in the cabinet, and through these relays transmit information to the monitor board and the pump controller in the boiler house.

A thermocouple is located in the elevated tank with copper-constantan wiring extended down to the transmitter, and d-c wiring transmits level and temperature information to the indicator-recorders at the monitor board. Wiring from the transmitter is extended, also, to a solenoid valve mounted in the pilot line at the pressure reducing valve to permit simultaneous operation of the



SCHEMATIC DIAGRAM
DOMESTIC WATER SUPPLY SYSTEM
Chrysler Corp. Assembly Plant, St. Louis, Mo.



MONITOR PANEL

Instruments record water usage in the boiler house and water levels and temperatures in each of the three storage tanks. Indicating lights, cycle selector switch and alarm stations are mounted under the instruments.

pressure reducing valve and the altitude valve in the fill line to the ground suction tanks, as previously described. A limit switch on the pressure reducing valve indicating its position is connected to the transmitter cabinet for further transmission of this indication to the monitor board. The transmitter is equipped, also, with a manual selector switch to permit manual as well as automatic opening or closing of the pressure reducing valve.

The double acting altitude valve on the line supplying the plant is equipped with a limit switch connected to the transmitter cabinet. This switch prevents pumps from operating after the altitude valve has closed and the water has reached the overflow level. Electric power is brought underground to the base of the elevated tank for operation of the transmitter components. Should a failure occur in this power, an alarm signal indicates this condition on the monitor board. Required synchronous motor time relays, installed throughout the control cabinets, prevent faulty operation of the controls occasioned by water surges or inconsequential momentary changes in the water supply system. The transmitter enclosure is equipped with thermostatically controlled heating elements to protect the controls from condensation. Direct current is employed for transmission of all electric signals between the transmitter at the elevated tank and the monitor board in the boiler house.

The second transmitter cabinet is mounted on the wall of the pit under the ground suction tanks. It houses electric power failure relay and condensation protection equipment, also components which sense water levels and temperatures in the tanks. This equipment is similar in nature to that housed in the cabinet at the elevated tank, described above. Wiring from the suction tank transmitter extends to the solenoid valve mounted on the altitude valve in the fill line to the tanks. This solenoid operates automatically to close the altitude valve whenever the system is on the pumping cycle. A limit switch on the altitude valve detects the position of the valve, and by means of electrical wiring transmits this information from the transmitter cabinet to the monitor panel, and thence to the transmitter and pressure reducing valve at the elevated tank. The pit under the ground suction tanks is furnished with a sump and an automatic sump pump to keep the pit dry. Should the pump fail, an alarm signal will be transmitted to the monitor panel to indicate the condition of high water in the sump.

Starters for the domestic water pumps are mounted in the general motor control center in the boiler house, and the control circuits which operate the starters extend to the pump controller cabinet located near the pumps.

Check Valves Hydraulically Operated

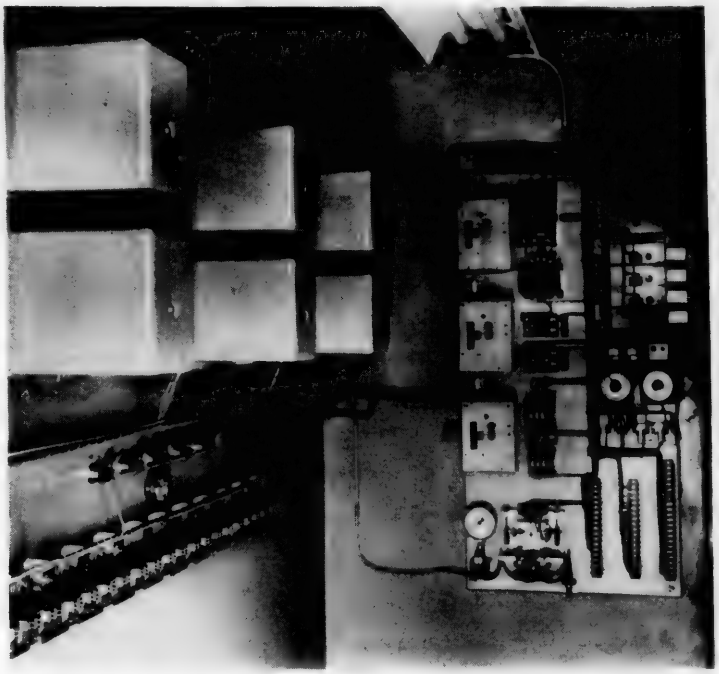
Each pump has a hydraulically-operated check valve installed in the discharge line. These valves serve to protect the distribution system from excessive water hammer and surges. Sequence of the valve operation is as follows:

The pump starts against a closed check valve, thus building up pressure between the pump and the check valve. When the pressure on the upstream side of the valve has reached a preset point, the check valve begins to open at a slow pre-determined rate, permitting normal operation of the pumps.

When the controls dictate pump shut down, the action begins with slow pre-regulated rate of closing of the check valve, while the pump continues to operate. The closing stroke of the valve slowly reduces the flow through it until, when the valve is practically closed, a limit switch on the valve trips out the pump. Failure of either pump to start when required will automatically start the second pump and simultaneously send an alarm signal to the monitor board. Wiring from the pump controller extends to limit switches mounted on the hydraulic check valves. These limit switches serve both to operate the valves and to report to the monitor board failure of equipment to open or close at the pre-determined

INSIDE MONITOR PANEL

The water level and temperature sections of the recorders are mounted in separate enclosures. The control chassis, far right, shows three transmitters for the recording instruments, control for indication of low pressure in fire main disconnect switches, control transformer, rectifier, time delay, and operating relays.



rates. Reset buttons, provided in the cover of the pump controller, permit manual reset of pump circuits after pump cut-off which has occurred because of failure in the hydraulic check valve operation. The pump controller contains an electric alternator to help equalize the wear of the pumps. Special relays are provided to cut-off the pumps when water level in the ground suction tanks drops to a low pre-determined level. Relays indicating the power failure at the pump controller and circuits for signaling the pump operation are installed in the pump controller enclosure with wiring to the monitor board to indicate these conditions.

Operator is Kept Informed

The monitor board in the boiler house is the center of the control system, and it provides separate operating, supervisory, and alarm sections. A door on one side of the enclosure housing the board permits easy accessibility and maintenance. Also located in the monitor board cubicle are rectifiers which originate the direct current for all circuits to the elevated tank and for the level and temperature recording circuits to the transmitter at the ground suction tanks. A cycle selector switch mounted on the board enables the operator to determine whether the system will operate in the normal or pumping cycle. In addition, the board contains indicating-recording instruments for registering the level and temperature of water in each of the three storage tanks. Each instrument is of the two pen type to record on 24-hour charts in different colors for ease of identification. The temperature pens in each of the three instruments are provided with adjustable switches to initiate alarm signals in case of low temperature of water. The alarm wiring provided is connected to the alarm section of the monitor board.

Mounted in the line with the instruments described above is a water flow indicator and recorder which registers the water usage in the boiler house. This instrument is connected electrically to the water meter located in the water main serving the boiler house.

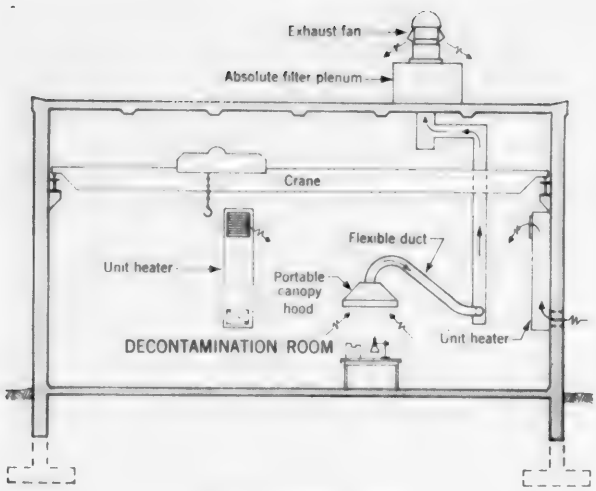
A static pressure line is brought to the monitor board from the fire protection piping system. This line is connected to pressure bellows in order to register low pressure in the fire main and initiate an alarm signal to indicate this condition. Time delay relays are provided to prevent faulty alarms occasioned by sudden surges. A pressure gage is mounted on the face of the board to indicate the water pressure in the fire main.

Five indicating lights, positioned under the instruments, inform the operator when the cycle selector switch is in the pumping cycle; which, if any, of the pumps are running; whether the altitude valve at the ground suction tanks is open; and whether the pressure reducing valve at the elevated tanks is operating. Thirteen alarm stations are mounted under the cycle selector switch. They indicate. individually, low levels in each of the three storage tanks; low temperature in each of the tanks; power failures in the two transmitters at the storage tanks and in the pump controller; failure of each hydraulic check valve to operate; low pressure in the fire main; and high water level in the pump sump located in the pit under the ground suction tanks.

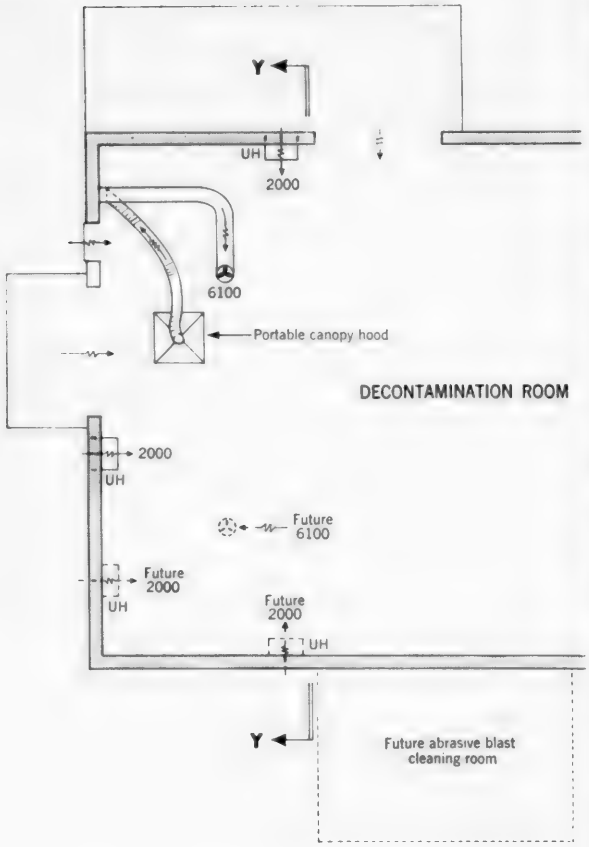
Each of the alarm stations, when actuated, sounds an alarm bell and turns on a light indicator. A silencer button is mounted under each alarm light to still the bell after the alarm condition has been detected. The indicator light or lights, however, remain on until the condition has been corrected.

All indicating lights glow at 10% of normal brilliance at all times to indicate that the lights are not burned out. When actual indication is required the lights obtain full brilliance.

Current is brought into the monitor board at 440 volts, and a 440/110-volt transformer is provided to furnish power for operating the control components. A separate 110-volt power line is brought into the cubicle to serve the indicating lights and the alarm stations.



SECTION Y-Y



Herein is shown how conventional air moving and heating equipment is designed into a heating and ventilating system, meeting the unconventional requirements of a building in which equipment and clothing contaminated by radioactive particles are cleaned for re-use or safe disposal. (Work done under auspices of the AEC)

Controlling Airborne Radioactivity During "Hot" Cleanup

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AN unusual dual-purpose "hot" laundry and "decontamination" building was designed, built and put into successful operation to house two different but related functions:

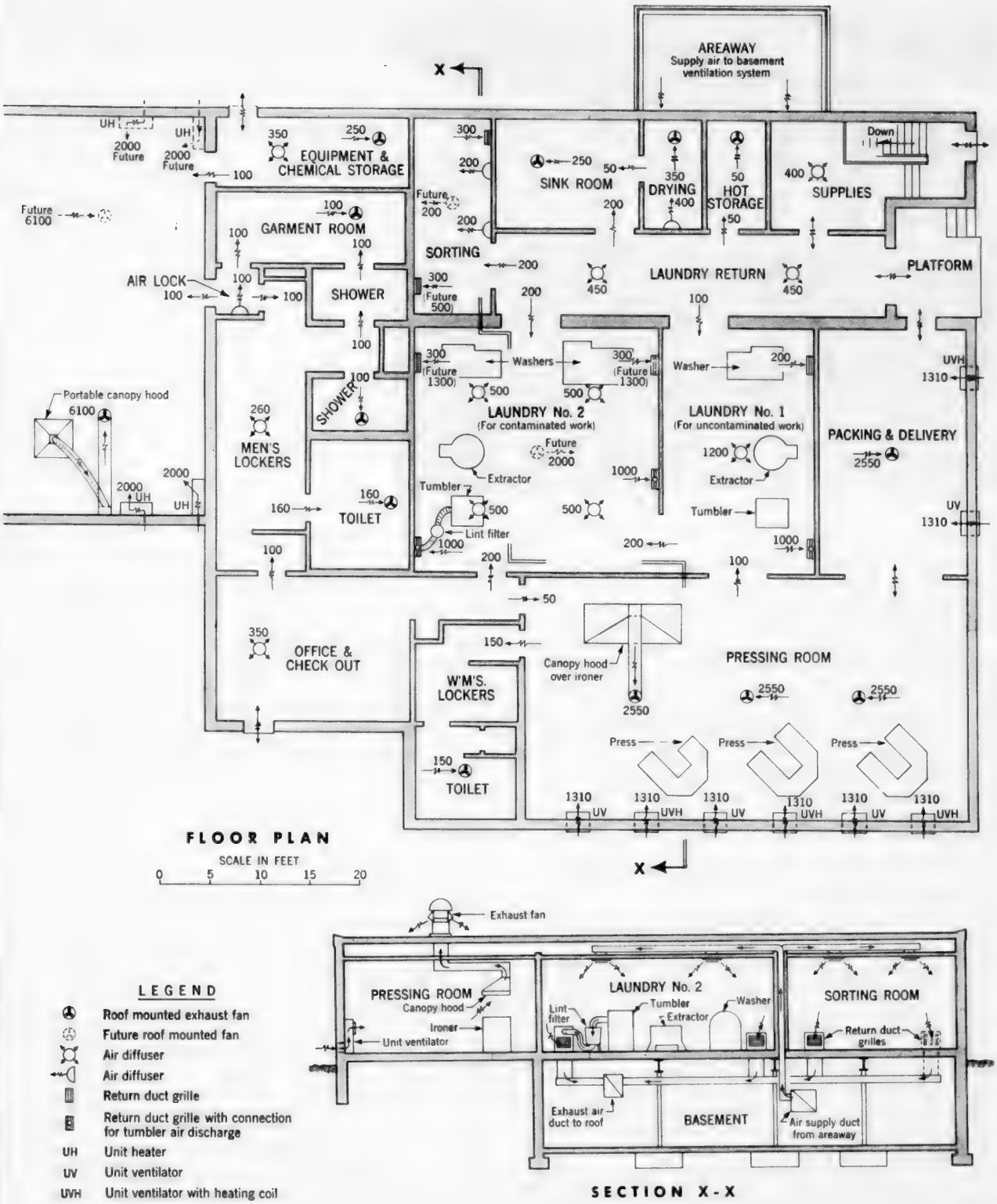
(1) Complete laundering, including decontamination, of a varied assortment of laboratory coats, gloves, etc., contaminated in varying degrees with radioactive material;

(2) Decontamination by washing, scrubbing, acid etching, scraping and sanding of any and all types of equipment, tools and materials, too "hot" for use, which must be cleaned to a degree permitting reuse or handling for safe final disposal.

These functions are completely different physically and must be isolated from each other, but, being closely related from a health physics control point of view, are under the guidance of the same health physics personnel, highly trained in radiation safety and measurements.

The 5000-sq ft "hot" laundry end of the building (see floor plan) is divided into a sorting room, two laundry rooms, a pressing room, a packing and delivery room, the health physics office, several special rooms, toilets, showers and locker room spaces. A hung ceiling covers pipes and ducts. Walls and floors are easily cleanable. Windows are fixed. Doors are self-closing.

The "decontamination" section of the building has about 2400 sq ft of completely clear floor space on grade finished with a special series of epoxy coatings for maximum ease of decontaminability. The ceiling is the underside of the roof. Ceiling, walls and the 5-ton bridge crane therein have minimum of horizontal surfaces to lessen dust build-up and to make cleaning easier. An exterior personnel door and two large rollup doors allow entry of trucks and trailers. There is no absolute necessity for



air conditioning and, indeed, the large ventilation rates would tend to make it prohibitive. Windows are fixed and both areas of the building are well lighted.

Requirements for "contamination" control in and between laundry and decontamination areas are as unusual as the building and are the prime reason for its special ventilation layout. The primary ventilation criteria, complete separation at all times of the two areas from an air flow and a foot-tracking point of view, follows from the fact that the "decontamination" end has a much higher level than the "hot" laundry end. It is "hotter" than even the "hottest" of the two laundry lines. The

Photo 1. Unit ventilators supply fresh air, heated as needed, to the "hot" laundry end of the building.

pressing and packing and delivery rooms in the laundry end are considered essentially "clean."

Double Ventilation Rate Provided

Ventilation air flow design criteria for the "hot" laundry end are twofold: The first requirement is that the air flow be at all times from the "clean" packing, pressing, health physics room and laundry and the "semi-clean" special rooms to and through the "hot" sorting and laundry rooms. A second, more unusual, requirement is that, in sorting and "hot" washing rooms, air flow must be from the ceiling towards the floor and that the flow have both a regular rate and provision for a double regular rate. This air downflow is for personnel protection from airborne radioactive lint and dust when opening the dry "dirty" laundry packages prior to their first wetting in a washing machine. Once clothes are wet there is a minimum danger that dust or lint might become airborne. The only non-standard design criteria for air quantity is based on the requirement of sufficient downward air velocity in the sorting and "hot" washing rooms to insure removal of airborne radioactive particulate, say approximately 50 fpm normally and 100 fpm at the double rate.

(The double rate would be used only for a few minutes, during the opening of the packages of dry, "dirty" laundry before they enter the washing machine. This is the time when there is the greatest danger from radioactive airborne particulates.)

Ventilation design criteria for the "decontamination" end of the building emphasizes an advanced degree of flexibility. It is necessary that a maximum of exhaust air velocity be available at the area of operations. This might be anywhere on the floor. At the same time, it is necessary that there be a minimum of air flow elsewhere, in order to minimize any general air movement and spread of "contamination." The criteria also requires that the ambient be sufficiently comfortable so that personnel can work under the rigorous handicaps of dangerous work in protective clothes, gloves and masks. Because the two basic criteria are diametrically opposed, it was necessary to work out the most reasonably safe compromise.

With systems of this degree of complexity and flexibility, much reliance must be placed on proper, intelligent operation. It is a practical impossibility to arrange all equipment and interlocks for completely fool-proof automatic operation. Therefore, the selection of equipment and the layout of systems to meet the aforementioned criteria is a balance between manual and automatic operation.

Air Lock Joins Two Areas

Primary design criteria, separation of the two main areas, was met by having the two different ends of the building separated by an air lock which connects them through personnel cleanup, shower and locker rooms. This air lock is pressurized with a separate positive air supply having no exhaust in the lock. Entrance to the lock is through three interlocked doors, so that only one door can be opened at a time. Anyone who is "clean" may enter the air lock through a door from the locker room and proceed to the "decontamination" end. On leaving this "hot" area, he would enter the air lock and leave it through the door to the cleanup room and shower before re-entering the locker room, either to leave the building or enter the "hot" laundry end.

To fulfill air flow design criteria for the "hot" laundry end, air quantities required by good practice are supplied to the pressing and packing rooms through low, wall-mounted, unit ventilators (see Photo 1) heated as needed, while sorting room, laundry, corridor, health physics, toilets and special rooms are supplied from the first of two basement ventilating systems.

Rooms on the first of two ventilating systems located in the basement are exhausted through power roof ventilators at sufficiently smaller air quantities than that supplied to ensure exfiltration towards the "hot" washing

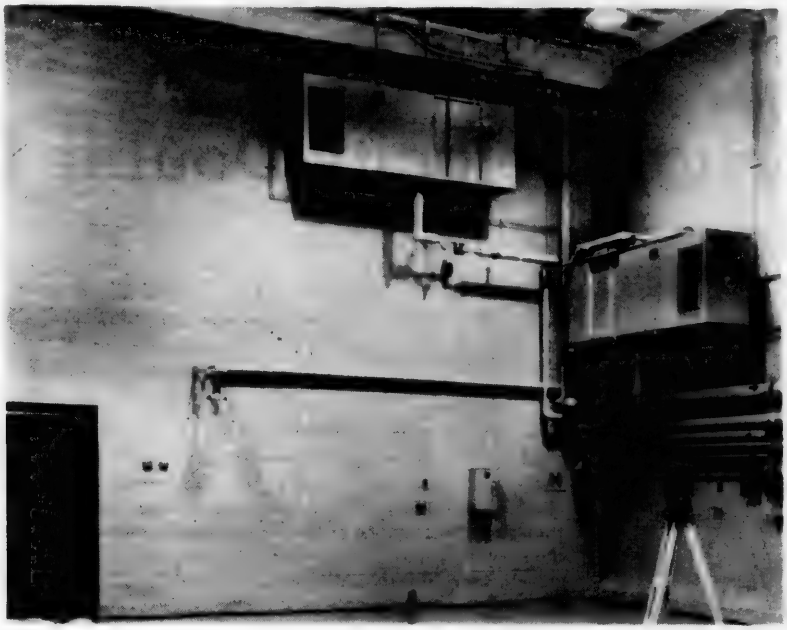


Photo 2. Wall-mounted unit heaters supply tempered ventilation air to decontamination room. At extreme right, near bottom, can be seen collar on duct to roof exhauster to which are attached flexible exhaust tubes from portable canopy hood.

and sorting rooms. These latter two rooms are supplied from a second ventilating unit through ceiling diffusers and are exhausted near floor level by an exhaust system, located in the basement, which removes air at a rate sufficiently greater than that supplied to ensure exfiltration from other spaces to these "hottest" rooms.

Total air quantity for the pressing and packing rooms is about 10,000 cfm; for the sorting room, 600 cfm; and for the "hot" laundry room, 2600 cfm. Both sorting and "hot" laundry rooms have provision for doubling supply and exhaust in the future. The ventilating systems are winter tempered only with wall hung radiation supplying building heat loss requirements. An exception is the pressing and finished goods rooms which have the heating coils in the unit ventilators.

In addition, space is provided in the basement for the future installation of water spray air washers in the main exhaust duct system for the "hot" sorting and laundry rooms if operations after a year or so indicate a need for lint and dust removal from exhaust air prior to discharge to the atmosphere above the roof. Also, each of the two clothes dryers (tumblers) have a special lint filter between their discharge and their connection at the low sidewall room exhaust ducts. These filters consist of a simple can-like container with an ordinary burlap potato bag suspended in it and they seem to perform admirably. (See Section X-X).

Radiant Floor Gives Low Air Velocities

Ventilation design criteria for the "decontamination" end was met by a combination of systems and arrangements. In order to permit the ventilating systems to operate only for contamination control they are winter-air tempered. Building heat loss is taken care of by the floor, a hot water radiant panel. The radiant floor results in lower air velocities than other systems of heating. There are presently two 6100-cfm power roof exhaust fans with provisions for two more. Both have absolute filters in a box under the fan. The suction end of these exhaust fans are ducted to 5 ft above the floor where they have a collar to which flexible exhaust tubes are attached (see Photo 2) and run to the area on the floor where the decontamination procedures are taking place. There the flexible tube is attached to a temporary canopy over the work, as or if needed. The reason for the sidewall connection is to permit unhampered operation of the bridge crane which must be used during decontamination work. (See Section Y-Y.)

Tempered ventilation air is supplied to the room by four fresh air unit heaters of 2000 cfm each, two for each exhaust, thus keeping the room under a negative pressure during "hot" operations. Each exhaust fan is interlocked with two of these unit ventilators so that supply and exhaust go on simultaneously. The unit ventilators are located to push air in the general direction of the floor area covered by the exhaust system with which they are interlocked. (See Section Y-Y.)

Modifications Planned

The following planning for possible future modifications has been made. The "hot" laundry end has structural provisions for future extension of the pressing room which is the most likely bottleneck if loads increase abnormally. The "decontamination" end also has structural provisions for extension of one or more bays if required by operations in the future.

In addition, the decontamination end has a temporarily blocked-up large doorway to permit access to a planned special decontamination room which will house air-abrasive blasting equipment. This equipment will allow controlled decontamination of items by the removal of the surface with shot which is vacuum recovered and cleaned for reuse in the decontamination cycle. This room would be large enough to take items 12′ x 12′ x 8′ and it will have its own separate compressed air supply, shot cleaning, air handling and ventilation with special filters on the final effluent and provisions for the additional installation of absolute filters if required.

Common-Sense Controls Keep Costs Down for High Velocity Double Duct Systems

N. J. JANISSE
Johnson Service Co., Milwaukee, Wis.

In a system with constant volume units, variations in static pressure in the duct system do not affect flow from the unit. Its desirable features have made the air conditioning industry "constant volume conscious." This emphasis has resulted in using constant volume control at times where it is not needed, even though it costs more than conventional control. To reduce the cost of double duct systems and still provide constant volume control where needed, constant volume and suitable alternate controls should be used as described herein.

THE constant volume system is popular because its sound level is constant. Sound variations, even at low levels, are more annoying than constant noise at somewhat higher levels. If a constant volume unit is selected for the proper sound level before it is installed, it will always be acceptable. As the public became more conscious of noise level, engineers began specifying units with sound levels lower than normally required. This made the problem of constant volume control more critical. Control and unit manufacturers were forced to provide boxes and controls which would control the volumes within plus or minus 5% of the rated volume.

Early high velocity systems were installed with pressure controls on the ducts and no volume control in the units. Thousands of units were installed this way and are still doing a satisfactory job. Sometimes portions of these systems presented problems. Some of the units were replaced with constant volume units. The satisfactory performance of these systems proved that jobs can be installed with constant volume units in part of the system and duct static control in other portions. Systems are still laid out with duct pressure control where flow from the units does not vary more than plus or minus 10 to 15%. The consulting engineer should consider this when designing a system. His layout should be studied by control and unit manufacturers to determine the type of unit and type of controls that provide the most economical job consistent with satisfactory results.

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Figure 1 shows an actual job designed to eliminate need for constant volume control. The fans are in the center of the basement. There is practically no pressure drop in the large plenum type risers that extend to the highest floor. Static regain is utilized by making all ducts of one diameter. Notice that each duct loops the building. If the south side is using less air from the hot duct than the north side, the south side helps supply the north. This system was installed with no static control of any kind and performed satisfactorily.

This ductwork would be considered too elaborate and expensive for most jobs. Most systems require controls either on the system or at each floor zone. Where system control is required, it is well to remember that proper readjustment of hot duct temperatures in accordance with load demands helps overcome system static unbalance. Also, attempt to keep the flow in 50-50 balance (50% through hot duct and 50% through cold duct). In addition to balancing the system, it assures that 50%, or at least a portion of the dehumidified air in the cold duct, is always entering the conditioned space.

Study of a system duct layout will indicate where to use units without constant volume control. As shown in Fig. 2, a building which has an executive suite area, a general office area, and manufacturing and shipping areas might be divided into constant volume and non-constant volume portions. Constant volume units would be used in the executive suites and probably in the office area. Large high volume units with constant volume control may be used in the office area to keep the amount of mechanical equipment and control apparatus to a minimum. In the areas where the background noise level is high, such as in manufacturing and shipping areas and where noisy office machines are used, conventional units (non-constant volume) are used. Duct static control is sufficient. Notice that the shipping room, served by the first unit after the fan, has no constant volume control. The duct pressure at this point should be relatively constant.

Early Troubles

Early constant volume control installations were relatively expensive and usually left very little profit for the control or unit manufacturer. Moreover, both control and unit manufacturers were trying to perfect their systems to give the customer the job that was promised. They learned a great deal for future development of units and systems. One of the biggest problems at that time was that the specifications did not make any one party responsible for balancing the system.

This responsibility was usually "dumped in the lap" of the control manfacturer supplying the flow controller who, in effect balances the system when adjusting the flow controller. The unit volume controller does not require that system pressure be held at any particular level; balancing the duct system is eliminated. Because the volume controllers force the fan to deliver a specific volume, many of the problems at the fan are eliminated.

Early flow controllers did not have calibrated dials and the balancing was expensive to the control manufacturer. In addition, the control manufacturer had little experience in this phase of the system and did not have personnel familiar with normal air flow and fan problems so it was a costly job to balance the system. This problem is solved when the specifications assign this responsibility.

Control of Flow at the Unit

Two things must be considered in deciding on control of flow at the unit:

1. How close should it be controlled?

2. How much can we spend to get control within these limits?

Three methods of controlling constant volume within units are commonly used today. Figure 3 shows a unit with an interconnecting linkage actuated by two operators. One provides the proper temperature mixture; the other provides a constant flow out of the unit. A flow controller measuring a pressure drop across a portion of the internal baffling controls one operator which simultaneously closes or opens both valves. The thermostat positions the second operator to the desired relative position to satisfy the temperature demands.

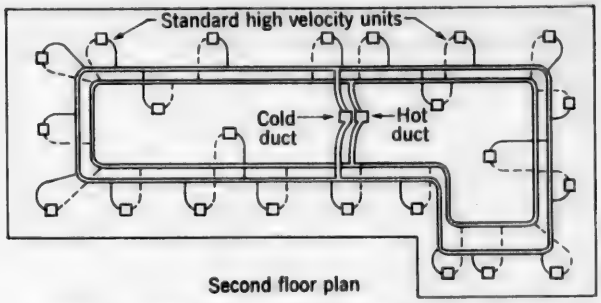

Fig. 1. System designed to eliminate need for constant volume control.

In the unit shown in Fig. 4, the thermostat actuates a device which proportions the amount of hot and cold air to satisfy the temperature requirements of the space. This hot and cold air is mixed in a high pressure plenum within the box. A constant volume control device beyond the plenum regulates the amount of mixed air flowing from unit. The possibility of momentary upset, due to a flow out of the high pressure portion into either of the ducts which carry a lower pressure, is not too remote. When this occurs, it is automatically corrected in time as eventually the thermostat will not be satisfied and the hot and cold air valves will be proportioned to overcome the temperature unbalance. This closes the valve on the high pressure duct causing more pressure drop and opens the valve on the duct carrying the lower pressure. This overcomes the back flow condition.

Figure 5 shows an arrangement with the cold and hot valve plugs directly attached to the operators. With this arrangement the thermostat actuates the warm air valve, and the flow controller, measuring a pressure drop across the baffling in the unit, operates the cold valve. As the thermostat changes the position of the warm valve to satisfy room temperature requirements, a change in volume occurs. This is measured by the flow controller which positions the cold valve to maintain constant flow. With this arrangement it is possible to be out of flow control when the cold valve is completely closed. This, however,

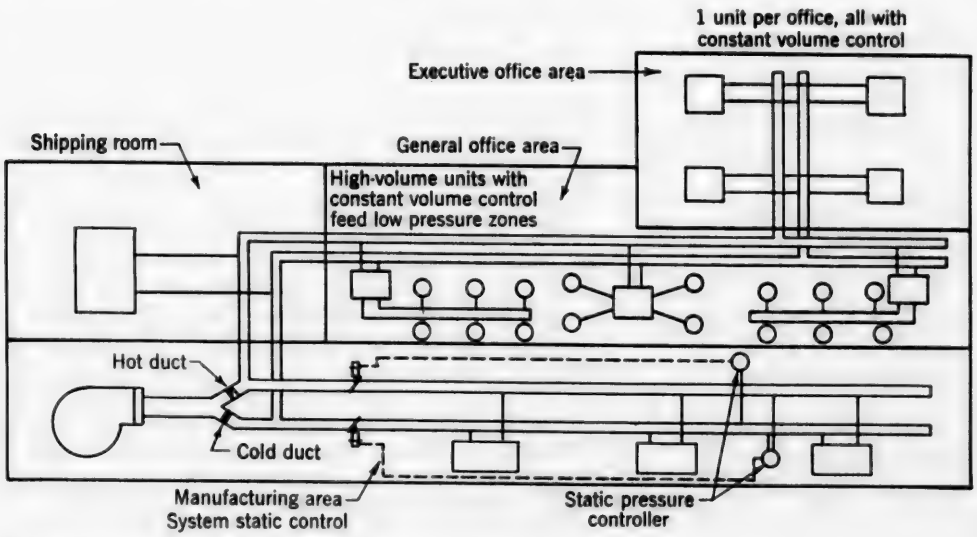

Fig. 2. Building divided for selective volume control.

Here are three commonly-used methods of controlling constant volume within mixing boxes:

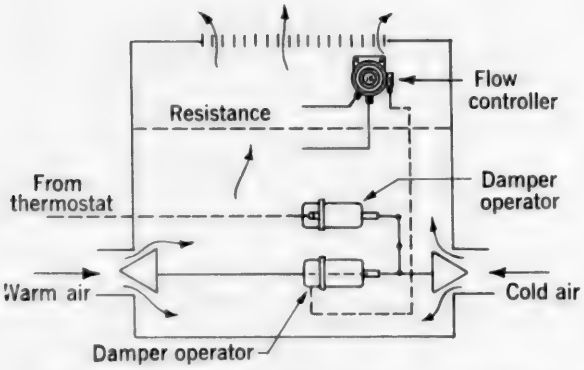

Fig. 3. Constant volume unit with mechanical interconnection between temperature and volume operators.

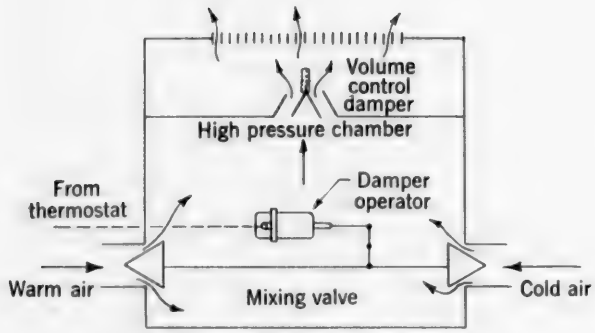

Fig. 4. Constant volume unit with constant volume control beyond high pressure mixing chamber.

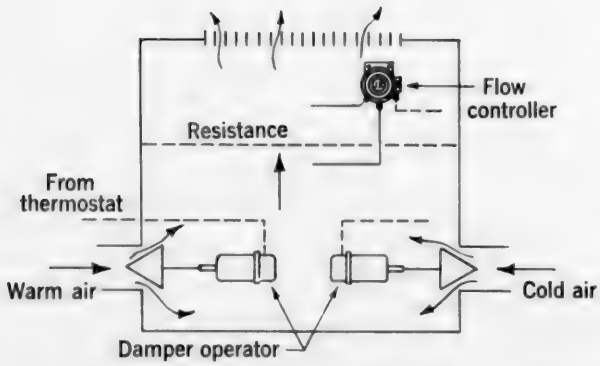

Fig. 5. Constant volume unit with minimum of internal operators. (Pneumatic interconnection of temperature and volume operators can be added)

happens only during warm-up periods when the building is not occupied, or during the design heating condition which is probably less than 5% of the time. If the thermostat is calling for all hot air, and if this amount of hot air is more than the normal volume requirements of the unit, the room requires this amount of hot air to satisfy temperature requirements or the thermostat would have shut the valve. The temperature requirements are usually considered more important than the volume and sound requirements at a time like this. To overcome this feature, which some consider an advantage and some a disadvantage, a pneumatic interconnection which permits the flow controller to override the thermostat when necessary, or mechanical devices such as sliding platforms, etc., can be installed.

Effect of Temperature on Unit Flow

Notice that in all methods a pressure drop, velocity pressure or conversion of velocity pressure is used to control the flow. Working over temperature ranges of as high as 60 deg, the density of the air varies as much as 10%. The velocity pressure and pressure drop vary appreciably for like flows. This error plus the changing flow pattern in boxes prevented the calibration of box capacity curves and flow controller dials to be worked out to the accuracies sometimes specified. Accuracies, however, to within plus or minus 5% of desired capacity are still possible.

Additional Pressure Costs Money

Some of the past difficulties were due to unrealistic specifications. Sound levels way below those required were specified. To meet these requirements the unit manufacturer selected units larger than those normally required. The very low flows through these large boxes provided practically no pressure drop through the unit. Drops of less than .05-inch were not uncommon. This was particularly true in the days when everyone was afraid of the noise or "undesirable sound", and many were still afraid of high duct pressure and high velocity. In fact, duct statics were held down so that the end boxes in many cases would not be allowed any more than ¼-inch w.g. at a maximum. Control manufacturers asked for a minimum of .1-inch w.g. drop across the baffles in the box when the box was used at its minimum rated capacity, but finally and reluctantly accepted a .05-inch drop when it was realized that the increased static needed in the duct often added an appreciable amount of fan horsepower. The increase of .05-inch seems minor. It was usually made at the minimum capacity of the box, however. When this box is used at higher capacities, this addition to the pressure drop increases appreciably.

The curves shown in Fig. 6 illustrate one job in which all pressure requirements should be kept at a minimum. They also indicate that the sheet metal contractor must do a good job of fabricating ducts and installing flexible duct connections. All of these items are important in keeping duct pressure drops at a minimum. Figure 6 shows that the increased cost is not nearly as important percentage wise on the 20,000-cfm system as on the 55,000-cfm system. It also indicates that the horsepower requirements were increased appreciably, and that the full load amperes, indicating the cost of operation, in-

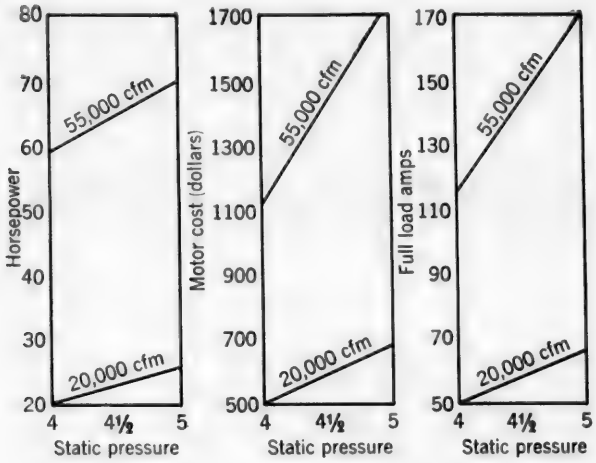

Fig. 6. Increased costs necessary to take care of increased duct pressure requirements.

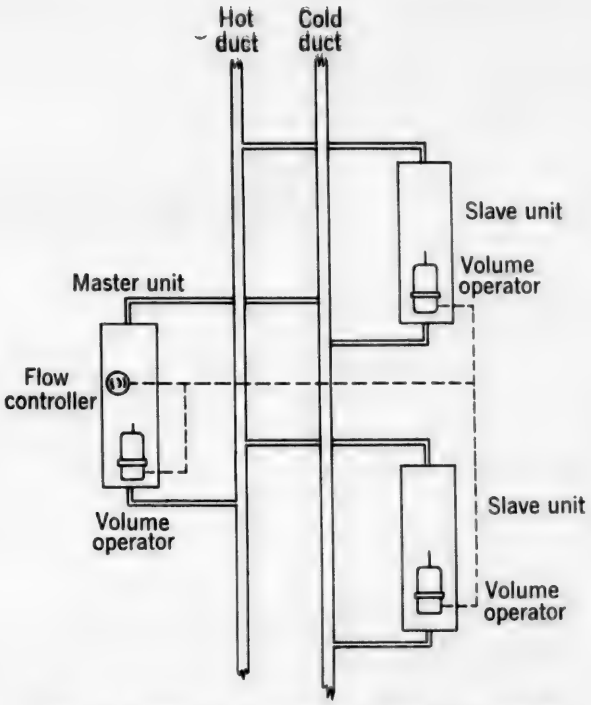

Fig. 7. System in which more than one unit is controlled from one flow controller.

creased so appreciably that additional apparatus and instrumentation could be justified to prevent the need of the higher system pressures. The initial cost of the fan or air moving apparatus also increased appreciably. These additional costs exemplify the need for proper selection of apparatus, design of system, fabrication of ducts, and specification of noise and flow limits to take advantage of maximum economy on the job.

Miscellaneous Methods of Reducing Job Costs

Job costs often sky-rocket when constant volumes at the unit are specified to be held within less than plus or minus 5%. It is extremely difficult for anyone to detect these variations of 5% in a comfort job.

Assuming that these specifications could be relaxed slightly, tests were made to determine whether more than one unit can be controlled from one flow controller. These tests indicate that it is possible to control, within this plus or minus 5%, by controlling two or three units from one flow controller. In a system of this sort the flow control device is installed in one unit. It controls the flow in its slave or companion units. The flow controller in the center unit in Fig. 7 operates the volume control operator in the other two units. To do this, however, the conditions have to be correct. It is required that:

1. Like pressure conditions exist at all three of the units,
2. The units must be of like size and selected for like capacity,
3. They must be controlled by the same thermostat, and
4. There must be a little chance for hysteresis in the box (this means a minimum amount of linkage).

All jobs where the units have been properly selected for this multiple type of control have worked very satisfactorily.

Use Large Volume Units

The possibility of using high volume units to feed low pressure zones should not be overlooked. This permits the use of one high volume unit, controlled at a constant volume, feeding a large area through low pressure ducts connected to ceiling diffusers, side wall outlets or, in some cases, under the window units, slots or grilles. This reduces the amount of mechanical and control apparatus and provides a very satisfactory means of distributing air to zones such as general office areas, etc.

Summary

To summarize the various methods discussed for keeping costs of high velocity double duct systems to a minimum, use this guide:

1. Study the system layouts to determine the most economical system and control arrangement. Does the system require that constant volume be used in all units, can the system be controlled with just system static pressure control, or is a combination of the two the most economical arrangement? If system static control is employed, be sure the measuring apparatus is installed at the proper location. Remember that units very near the fan, where the pressure is nearly constant, may not require any control at all.
2. Be sure units are properly selected so that they can be controlled, and be sure proper thought is given to the location of measuring tips, etc., so that the calibrated dials on flow controllers can be used to advantage during initial adjustment.
3. Select the simplest, most trouble-free type of units.
4. Keep duct pressure to a minimum as this may affect operating costs as much as 30%.
5. Consider the possibility of controlling more than one unit from one flow controller.
6. Use large volume units wherever possible.

Heat Pump Hermetic Motors

Protection of the hermetic motor in heat pumps is of extreme importance. It is the purpose of this article to review many of the present protective devices on heat pump motors, and other air conditioning motors, as related to the limitations attendant to them, and to introduce a new approach to this very challenging problem.

SINCE the introduction of the motor into the hermetic refrigeration system, the problem of providing adequate motor protection has been one of major concern and challenge to engineers. During the period of roughly 30 years of applying hermetic motors, many different approaches have been tried in an effort to provide a means of both sensing abnormal motor operating conditions and protecting the system accordingly. Basically, the problems have been the same with motors used on refrigeration and air conditioning applications regardless of size. However, because of design differences in compressors over these ranges the protective devices have taken on different forms.

Prior to the advent of the heat pump, the operating range of a particular motor was generally limited to a specific band of operation and load, dependent upon the ultimate use of the compressor. Because the air-to-air heat pump must operate in the air conditioning range during the summer and part of the winter, and in the refrigeration range during the remainder of the winter, the motor load variation has been greatly expanded. The location of the compressor and controls outdoors, thus exposed to a wide range of ambient temperature variation, has made motor protection even more difficult.

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Protection of the hermetic motor in heat pumps is of extreme importance for several reasons. Not only is motor replacement costly, but the accompanying effects of system contamination and control damage create additional cost, time and labor before the heat pump is returned to normal operation. Increased down time can be ill afforded during the heating season for users are far more sensitive to temporary lack of heating than they are to lack of cooling.

It is the purpose of this article, therefore, to review many of the present protective devices used on heat pump and air conditioning motors as related to the limitations attendant to them, and to introduce a new approach to the problem which to date has indicated major success toward a practical and broad solution.

Motor Hazards

In order to properly correlate the methods of motor protection with the particular causes of motor failure, it would be well to summarize basically the factors affecting the limitations of hermetic motor operation. These are as follows:

1. Overload. Although the design criteria for a hermetic motor are not the same as for a standard open motor, the limitations of maximum load are similarly established. Consequently, this term requires no further elaboration.

2. Improper cooling. Motors in hermetic compressors rely mainly on the refrigeration flow for cooling and to a small extent only on radiation from the compressor to the air.

Figure 1 shows a typical hermetic motor efficiency curve indicating that the efficiency is very low at low loads, practically constant from medium to high loads, and drops sharply at extreme loads. This curve needs to be related with the operating characteristics of the compressor to identify the critical conditions of overheat. With a constant suction pressure, capacity and power curves versus discharge pressure for a compressor are shown in Fig. 2. It can be seen that an increase in discharge pressure not only increases the motor watts but

Require Special Protection

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also reduces the refrigeration capacity. The capacity is reduced because the refrigerant flow is lower, which means the motor cooling has also been reduced. Thus, it is obvious that the maximum discharge pressure establishes one of the limiting motor temperature points.

Plotting these same functions as related to suction pressure, it can be seen in Fig. 3 that as the compressor capacity increases, the motor watts also increase up to a point where a maximum occurs. Since the capacity (pumping rate) increases beyond the point of maximum motor watts, the motor becomes cooler and cooler with increasing compressor output as long as the motor efficiency does not decrease. The motor efficiency curve indicates, however, that motor heating is greater at lower outputs and this increase takes place because of the sharp decrease in motor efficiency at light loads. To date, all motor tests have proven this to be true. Superheat of the suction gas at these conditions also becomes increasingly important for the temperature of the suction gas has a direct effect on the motor temperatures in the same way that ambient affects an open motor. Therefore, the motor temperature is increasingly more critical as the compressor load conditions decrease and a danger point is approached. Since in a heat pump the pumping rate of refrigerant is reduced during the heating cycle at low outdoor ambients as compared to the cooling cycle rate, proper motor cooling is of major concern on heat pump motors.

3. Abnormal or unbalanced voltage conditions. In addition to the operating loads of the compressor just discussed, motor temperature is also affected by voltage variation. Figure 4 shows a typical motor temperature curve as related to voltage variation. Curves for various motors are not always centered as shown, but even though they may be distorted in one direction or the other, the motor temperature must be within the design limitation at both ends of the normal voltage variation range, usually $\pm$ 10%. It is apparent that voltages outside this range have a serious effect on motor temperature. In general, the higher voltages are more critical at light loads and the lower voltages at heavy loads.

Unbalanced voltage results in increased current in one leg, which if unchecked, will cause motor overheating. Single-phasing will also fail the motor if undetected.

4. Mechanical or inherent motor failure. This type of failure may occur from improper insulation, vibration or movement of the coils or end turns, poor connections, damage during installation, etc. Since the only protection satisfactory to prevent this type of failure is good design and quality of manufacture, it will be excluded from future discussion.

5. Improper compressor or system component operation. Malfunction of the compressor valving, unloading or lubrication system will affect the motor heating and load. Reduced motor cooling occurs through the loss of refrigeration or through four-way valve leakage which permits hot gas to be bypassed directly into the suction line. Failure of the defrost control to operate will result in abnormally low evaporating temperatures for extended periods. Actually, these inter-relations are too numerous to enumerate, but it is obvious that defective performance of any component in the system may have a direct effect on the motor through its effect on either motor load or the temperature of the cooling gas.

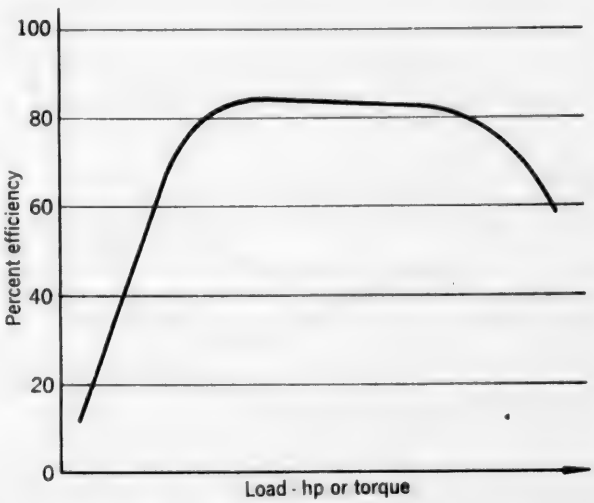

Fig. 1. Hermetic motor efficiency curve.

Indirect Motor Protection

Several types of system controls are used to assist in the protection of the motor, although they are normally not considered to be in the strict sense motor protective devices. One of these is the suction side low pressure safety cutout. It protects the system against loss of refrigerant and against pumping rates which will not provide adequate motor cooling. When used on a heat pump, its setting must be considerably reduced from that of a standard air conditioner because the range of normal operating conditions extends to lower suction pressures; and thus its effectiveness is also reduced. The discharge side high pressure safety cutout may act also as a load limiting device under certain conditions.

Direct Motor Protection

Direct motor protective devices may be divided, for our purpose, into three general classes. The first is the "remote type" which is normally mounted on the starter or in the control box. A second type can be called "close-coupled" since this control is mounted in direct contact with the compressor housing, and the third "internal" inasmuch as it is mounted within the hermetic enclosure and directly on the motor. The first two types are those in general use today and the third type has recently been developed and announced but is not yet in broad commercial service. Each of these will be described with its features and limitations noted.

Remote Type Protective Devices

Remote type protective devices appear in three forms: thermal industrial overload relay, thermal quick-trip overload relay and magnetic overload relay.

Thermal Industrial Overload Relay. For some time the termal type industrial overload was used as a means of hermetic motor protection. It is a current sensing overload and will trip the motor from the line when the current reaches a certain value. The industrial type overload is made in various forms, but in essence, it consists of a resistance carrying line current. As the current increases, heat is generated causing a bimetal to deflect and actuate the relay contacts when the temperature of the bimetal reaches its critical value. The overload is calibrated in terms of current required to produce sufficient heat to cause this tripping. Because of its principle of operation the overload will trip at different values of current in different ambient temperatures. Higher ambients require less generated heat or less current to produce tripping, and lower ambients require increased current. For this reason the ambient must remain nearly constant or one of various means of compensation for ambient temperature variation must be used for maintaining trip current accurately. Since these overloads were basically designed as "thermal images" for protection of open motors, where the effect of ambient should be included, compensation is not normally available in refined form.

If the ultimate long-time trip current was all that had to be considered, one type of overload would be adequate for all applications. However, hermetic motors are applied at higher ratios of normal load torque to pull out torque than are general purpose motors, and will, therefore, have a higher ratio of nameplate or full load current to locked rotor current.[1] This means that hermetic motors will have a lower ratio of locked rotor current to overload ultimate trip current and a normally applied industrial thermal overload will require more time to trip the motor out at locked rotor conditions.

Figure 5 shows a typical thermal industrial overload trip characteristic curve. The necessity of removing a motor from the line in approximately 12 to 15 seconds at locked rotor conditions to prevent excessive temperatures from being reached is one of the main points to consider in overload application. As indicated on the curve, approximately 600% trip current is required to open the circuit in 15 seconds. If a lower percentage of trip current is obtained in an application, the trip time will be increased. This is the case in a hermetic application, and therefore the thermal industrial overload relays will not properly protect hermetic motors at locked rotor conditions. Also, no protection is afforded at light system loads, which are characterized by low flow of cooling gas when the motor currents are low.

From this can be seen the need for a different type overload protective device that will trip as quick, at possibly 350%, as the industrial type overloads tripped at 600%.

Thermal Quick-Trip Overload Relay. Thermal quick-trip overloads are essentially the same as thermal industrial overloads except that heating characteristics have been changed to alter the bottom part of the curve at values above 150% of the ultimate trip current as shown in Fig. 6. The quick-trip overload is superior to the industrial type for protection of hermetic motors in that it provides protection at both critical steady load and locked rotor conditions.

Magnetic Overload Relay. As previously mentioned,

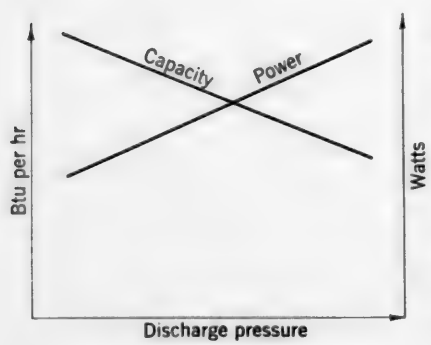

Fig. 2. (Left) Effect of discharge pressure on compressor performance.

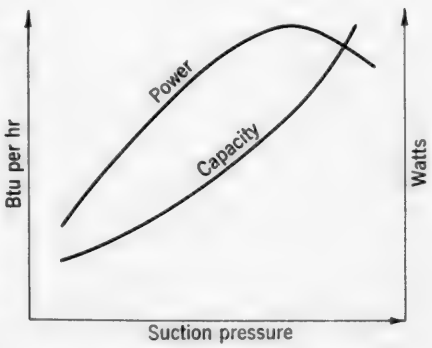

Fig. 3. (Right) Effect of suction pressure on compressor performance.

the ultimate trip current will have a given value at a definite ambient temperature. Since the controls for so many of the present heat pumps are exposed to such a wide range of ambients, it becomes even less desirable to use the thermal type overload, but requires instead an overload with the characteristics of the thermal quick-trip type, but insensitive to ambient temperature variation.

There is available a device of this type in the form of a purely magnetic relay. It is directly actuated by the line current to the hermetic motor. When the current reaches the established limit, the relay operates to remove the motor from the line. This relay employs a movable core which displaces a liquid as it moves. Because the fluid prevents rapid movement of the core, it provides the inverse characteristic and on locked rotor conditions it can be adjusted to obtain the same results as the thermal quick-trip overload.

A relay of this type can be accurately calibrated in terms of current, and, because it is magnetic, is unaffected by ambient temperature within the ranges of heat pump application. Although this relay offers excellent protection against overload and locked rotor conditions, it, like both types of thermal relay, offers no protection against low gas flow conditions.

Close-Coupled Protective Devices

The motors of small compressors, particularly those sealed in a "can," are frequently protected by a combination current and temperature control. This consists of a bimetal thermostat which is securely fastened to the external shell of the motor-compressor unit. It thus senses increased shell temperatures created by an increase in motor temperature. In addition, the motor current is passed through a resistor which is located within the thermostat casing and thus serves in the manner of an anticipator. This protective device has its greatest limitations at light loads because it cannot sense changes in motor winding temperature quickly enough at decreased currents. It is also affected by ambient temperature variations, tending to trip prematurely at high ambients and too slowly at low ambients.

On larger compressors and also small ones with heavy castings another form of close-coupled device has been used. This consists of a thermostat placed on the discharge side of the compressor where it senses discharge gas temperature. It has been determined that improper operation of various system components as well as excessive motor heating is reflected in the temperature of the discharge gas leaving the compressor. When applied together with some form of remote type protector, the combination provides both current and temperature protection. Limitations also exist with the discharge thermostat in that some time lag is present in transferring a rapid change in motor temperature to the sensing device. It also may fail to protect against the effect of a loss of charge in an expansion valve system.

Internal Protective Devices

To eliminate the delay factor in transferring motor temperatures to the outside casing, work has been progressing for some time to move the thermostatic control to the actual windings of the motor. It is felt that only by quickly sensing and immediately limiting motor winding

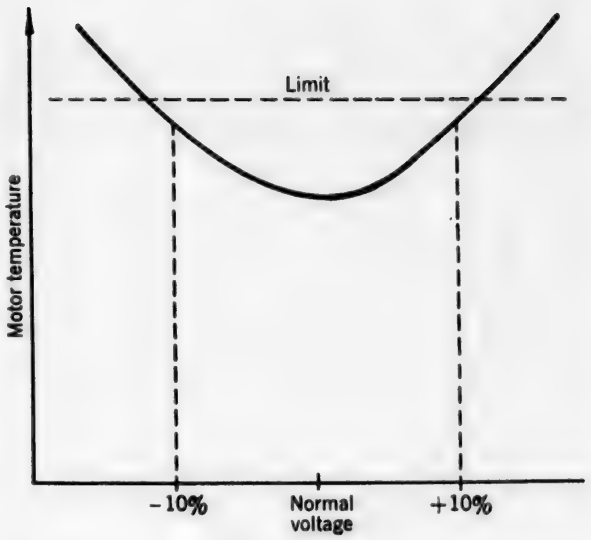

Fig. 4. Curve showing voltage effects on temperature.

temperature can the motor be protected from thermal damage. The development of a new temperature sensing device which employs a thermostat buried in the end turns of the winding has recently been announced.[2] At this writing, details of construction and performance of this system have not been published insofar as is known to the writers, but it is expected that this device will be a miniaturized version of the familiar embedded detector, especially designed to be compatible with the environmental conditions of a refrigerant system. This device may provide a major advancement in hermetic motor protection because it attacks the problem at its source. It is believed that this type of control should have excellent response characteristics for gradual temperature changes, but the problem of minimizing thermal lag through the necessary electrical insulation limits the rapidity of response.

Development of a new system of inherent motor protection is nearing completion. It consists of small thermistors embedded in the motor windings with a control circuit to sense their response to winding temperature and actuate protective circuits. This new system, called Guardistor, has three novel characteristics:

1. The thermistors are very small, and, being semiconductors, require little mass of electrical insulation. Thus, thermal lag between winding temperatures and thermistor temperatures is minimized, and response to rapid temperature changes is more accurate.
2. The thermistors produce a larger change in resistance at their critical temperature than previous thermistors. Also, their critical temperature is more sharply defined, and is capable of accurate control in their manufacture.
3. The thermistors are of the positive temperature coefficient type, which permits the use of a fully fail-safe circuit. This means that any defect in the thermistors or associated circuitry cannot occur and still permit an external indication of a safe motor condition. Previous negative temperature co-

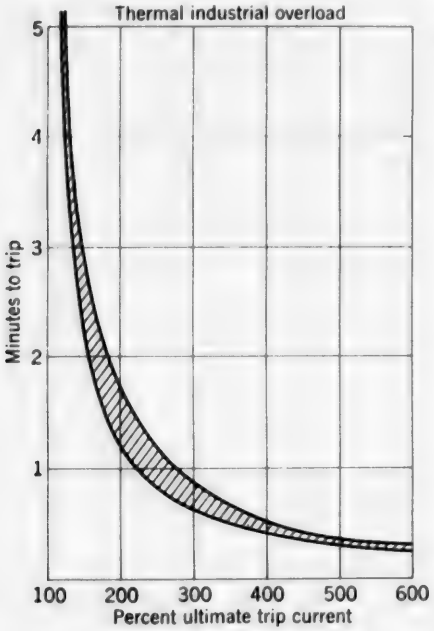

Fig. 5. (Left) Trip time current curve for thermal industrial overload relay.

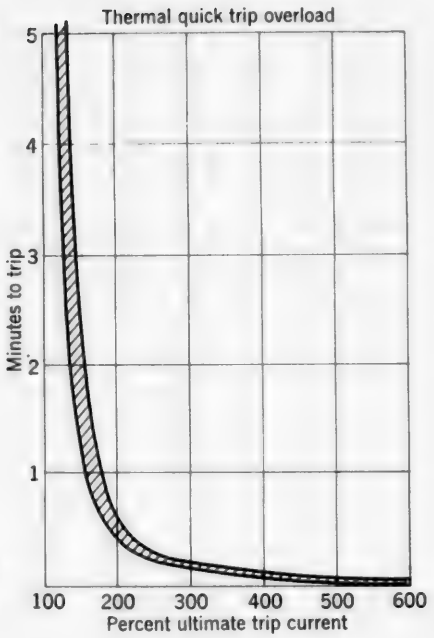

Fig. 6. (Right) Trip time current curve for thermal quick trip overload relay.

efficient thermistors seemed inherently incapable of this type of operation.

Experiments were conducted to determine the effectiveness of the new system under actual operating conditions. Thermistors were applied to the windings of a 7½ hp, 220 volt, 3 phase, 60 cycle, 4 pole hermetic motor in a compressor using Freon 22 along with thermocouples for measuring winding temperature. One thermistor was embedded in each phase of the winding and connected with the fail-safe control circuit. The circuit was arranged to open the motor contactor when the thermistors exceeded the critical temperature, and to reclose the contactor when they fell below it. Tests were conducted under all conditions known to create high motor temperatures, and in addition abnormal conditions such as high compressor suction temperature, and abnormally low or high voltages were imposed. The following tests were made:

1. Light load (poor motor cooling) at 115% rated voltage.
2. Heavy load (good motor cooling) at 85% rated voltage.
3. Heavy load with 18% voltage unbalance.
4. Loss of refrigerant charge.
5. Single phase locked rotor.
6. Three phase locked rotor.

Each test was conducted for approximately eight hours except the three phase locked rotor test which continued for 20 days. Cycling occurred in response to the thermistors as they heated and cooled with the motor winding. The critical temperature for re-starting the motor averaged 25 deg F below the critical temperature for stopping the motor. The thermistors cut the motor off at a temperature slightly higher than that considered safe for the insulation to withstand continuously. Motor temperature was held within safe values in every test with the cut-out temperature (measured by thermocouple) practically constant and the same regardless of the type of test. At locked rotor condition the response was considered adequate since the winding temperature (measured by thermocouple) did not exceed 150 deg C on the first cycle at cold start and the over-shoot decreased rapidly on succeeding cycles.

To date, no condition nor combination of conditions has been found which would cause motor damage wherein the thermistors failed to protect the motor. With the thermistors sensing motor winding temperature, protection is provided on the basis of total temperature alone. This system may eliminate the necessity for dealing with the factors that indirectly cause increased temperature such as poor cooling, high current, ambient, voltage, etc. The system is now being field tested in heat pump units.

Summary

A review has been presented of the conditions existent in heat pump operation which are potential trouble sources to the hermetic motor and for which protection must be provided. Existing methods of heat pump hermetic motor protection were listed as follows: The thermal industrial overload relay, thermal quick-trip overload relay, magnetic overload relay, current biased thermostat, discharge gas thermostat and the recently-announced embedded thermostat. The effect of each of these devices has been discussed and its limitations evaluated. All were found to be less than completely satisfactory at light load or locked rotor conditions.

Preliminary information and test data were also presented on a new system using thermistors. The results obtained to date indicate that this system should remedy the deficiencies present in existing devices.

References

1. What is an Air Conditioning Horsepower?, P. W. Wyckoff, *Electrical Engineering*, July 1956, pp. 602-606.
2. Temperature Sensing Device Protects Against Motor Burnout, *Air Conditioning & Refrigeration News*, August 11, 1958, pp. 18.

ACHV BUILDING TYPE SECTION

Air Conditioning the VARIETY STORE

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Variety stores are the merchandisers of a very wide group of articles. In addition they include major food departments, lunch counters, and may sell pet fish and birds. This article presents information on the design and operation of air conditioning systems for such stores. This company has approximately 160 variety stores located in 35 states. The authors have had extensive experience in the design of air conditioning for this type store.

Air Conditioning the Variety Store

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THE variety type store, featuring articles ranging in price from 5 cents to $1 and over, attracts large volumes of traffic-inducing impulsive purchasing. The advent of the self-serve type store has placed the variety store in a class formerly enjoyed only by the so-called top quality store. Therefore, the variety store is now at the top of the list of stores needing the benefits of air conditioning.

The varied requirements of a variety store, when considered for air conditioning, can challenge an engineer's best abilities and tax his imagination and ingenuity. There is almost an endless variety of articles on sale. To list a few, they are hard goods, soft goods, sports goods, pets of all description, including monkeys, fish, birds and the like. Among other things, the variety store has become a major food merchandiser, from the customary lunch counters to fabulous installations, augmented by stand-up type food centers offering such odorous items as frankfurters, hamburgers, and pizza. The chances are good that if you name some merchandise item, the variety store will have it, and the engineer has had to consider it in his air conditioning design.

The progressive variety store operator today finds himself in a position where he no longer can operate without the benefits of air conditioning.

Taken for granted today are such business operation items as increased sales, no summer sales slump, increased traffic, decreased mark-downs, cleanliness, labor relations and public relations. More specifically, such things as "comparableness" to competition must be noted as well as control of odors emanating from foods, preservation of perishable items, pleasant conditions, and customers' comfort. Employees' comfort is most important for generally it is conceded customers are easier to acquire than good employees.

The variety store can range from one requiring a single small packaged air conditioning unit to one requiring an extensive system that has a centrifugal chilled water installation operated through many controlled zones. Usually the built-up, direct-expansion job is the characteristic installation, and the tonnage is usually somewhere between 30 and 200 tons. The sales area generally is between 9,000 and 40,000 sq ft.

Stock Rooms

In some instances, especially so in southern stores, stock rooms will be conditioned. Rest rooms for female sales clerks should always be considered, since women are the major employees of a variety type store. The variety store, in a great majority of cases, uses the street floor and basement for sales areas, or else the street floor only. Stores are usually rectangular or L-shaped, having one or more entrances. Because of high cost of construction, the trend today is toward a single level store with stock areas located at the rear of the store.

Air Conditioning Design Data

Variety stores are mostly chain-owned and operated. Air conditioning surveys are made from detailed drawings prepared by the owner's architect or by its own engineering department. It is most important that the designing engineer have complete information regarding the particular store. Specifically, he should have a plot plan, complete architectural plans, plumbing and electrical plans, types and availability of all services, rates for same and location of services entering the building. In some areas, water hardness can be a major factor. A study must be made of available waters.

Lighting, people, food serving departments, and ventilation constitute the principal heat loads. It should be expected that the owner, rather than the design engineer, will establish the people load. Most chain variety stores have different classes of stores designated as *A*, *B*, *C*, etc., depending on location and size of store. Between classes of stores, merchandise on sale will vary. For instance, all stores do not carry pets and will not be equipped with lunch counters.

It is the consensus of opinion that design data cannot always be taken as standard when designing air conditioning systems. Usually, in order to standardize and simplify engineering calculations, inside conditions are 80 deg F dry bulb with a simultaneous relative humidity of 50%.

Specific design of the store's air conditioning system should generally take into consideration the following:

1. Store's location latitudinally.
2. Orientation of glazed areas.
3. Outside design conditions.
4. Heat transmission losses.
5. Heat from lighting.
6. Heat from cooking appliances.
7. Heat from special merchandisers and displays.
8. Heat from powered equipment.
9. Population density (sales and stock areas).
10. Ventilation requirements.

The accepted factors applied to this list of heat gain items are generally used. Experience has proven that this procedure is satisfactory and economical, and also meets with most landlords' approval.

Heat Gain from Lighting. Present-day merchandising

* Information pertaining to electrical features was prepared by John A. Leys, electrical engineer, Neisner Brothers, Inc.

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S. L. Sloan, Jr., a native of Atlanta, Ga., has been associated with the air conditioning and refrigeration industry for thirty years. For sixteen years he has operated his own mechanical contracting and servicing business and has served in an engineering capacity for the design of many large store operations. He joined the engineering department of Neisner Brothers, Inc., four years ago.

demands intense lighting with special lighting for certain items such as jewelry displays, lighting fixture displays, and other specialties. The per square foot wattage can run as high as 6 watts per square foot. However, in the interest of standardization, a square foot wattage of 4 watts per square foot is used in determining heat gain from lighting in all sales areas. Where stock areas are conditioned, a factor of 2 watts per square foot is used. This also applies to receiving, marking, toilet, and rest room areas.

Heat from Cooking Appliances. Factors for this item are also taken from available data. The class of store generally determines the type and variety of appliances which are used. The design engineer should avail himself of this information from the owner of his restaurant equipment suppliers.

Heat from Special Merchandising Displays. Many food delicacies are featured in the variety type store and require cooking appliances for their preparation. These items are popcorn, pizza, frankfurters, hamburgers, doughnuts, roasted chickens and cooked nuts. The heat load from these special merchandisers should be taken from the respective manufacturer's published data.

Heat from Powered Equipment. Most variety stores provide mechanical amusement rides for the kiddies. Heat loads from this source also can be obtained from published data.

Population Density. Based on operating experience, it has been found that the following gross sales area figures prevail during periods of steady traffic:

First Floor—50 sq ft per person.
Upper Floors—100 sq ft per person.
Basement—100 sq ft per person.
Stock Room—200 sq ft per person.

Ventilation Requirements. Outside air supply is usually 10 cfm per occupant for sales space and other conditioned areas, and usually 15 cfm per occupant for restaurant spaces separate from sales areas or provided with individual air conditioning.

The total outside air should be figured on the basis of occupants or the exhaust quantities plus one air change, whichever is the greater. A positive pressure should be maintained in the conditioned space to assure exfiltration through the entrance doors and serving doors, or serving area for food.

Equipment Selection

Selection of the type of equipment to be employed must be, and always is, a factor which remains with the landlord. Arrangements are provided in the lease agreement. Specifically, the most economical system which can be developed will be given first consideration since rentals are based upon total costs for preparing the premises for occupancy. The final selection of equipment then becomes a situation to which the engineer must give careful study.

Among the many things which must be considered are: Floor space that will have to be given up for equipment, cost of operation, cost of maintenance, and simplicity of control. Quite naturally, a store having only 9,000 to 16,000 sq ft of sales area cannot tolerate space being taken from the sales area to accommodate air conditioning equipment. Therefore, penthouse arrangements, suspended units, or roof-mounted units must be considered. Arrangements of this kind are now available from many manufacturers. Such equipment is usually self-contained and is factory-assembled; generally, it has proven least expensive, easy to maintain and, in most cases, it has been found highly efficient. Today's trend is towards air-cooled equipment which does not require expensive-to-maintain water cooled equipment.

For stores above 16,000 sq ft of sales area, built-up types of systems will prove to be more economical. Due to the greater sales volume of such stores, adequate maintenance to operate this type of system becomes economically feasible. Since high values are placed on possible sales spaces, the location of machine room space becomes a major factor. Wherever possible, machine rooms should be located in areas which have the least value. They can be planned for mezzanine, roof, or basement areas. Codes in various cities should be investigated as these regulations will sometimes restrict the choice of design.

Electrical Service

Electrical considerations are a major problem in the design of air conditioning systems for stores of any type; one of the first steps to be taken in connection with designing the electrical installation for an air conditioning system would be to contact the power company involved for the following information:

1. Location and type of service entrance.
2. Characteristics of service available.
3. The maximum permissible limit of the current

drawn from the distribution system during each step of the motor starter, as well as the time that must be allowed between each step.

4. The maximum amount of locked rotor current permitted for motors designed for full voltage or across-the-line starting.

After this information is obtained and the size of motors to be used has been determined, the type of starter and the type motor to be used can be selected.

The size of the main service, main disconnect switch, distribution panels, switchboards, and/or switch gear will depend on the total connected air conditioning load plus lighting, appliances, and other motor loads used in the building under consideration.

Motors

Motors are usually designed for 208, 220, 440, 550-volt operation or higher, if size and type of installation permit. For best results, motors should be operated at their normal load, voltage, and frequency. Under some conditions, a service factor of 1.1 may be applied if the rated voltage and frequency are maintained. All motors are provided with a name plate giving the rating of voltage, amperage, horsepower, normal full load speed, rated temperature, and intervals of operation at full load before reaching this rated temperature, except in round rotors with a code letter. Several type motors, frame construction, class of insulation, or code letter markings are available, and each installation should be considered as special, so that the correct type motor application can be made.

Code letter indicates the motor input in KVA per horsepower with locked rotor, and this information must be used in connection with power company requirements as well as in determining the size branch circuit overcurrent protection to be used. Two-winding motors, as well as wound rotor motors, are usually quite adaptable to power company requirements.

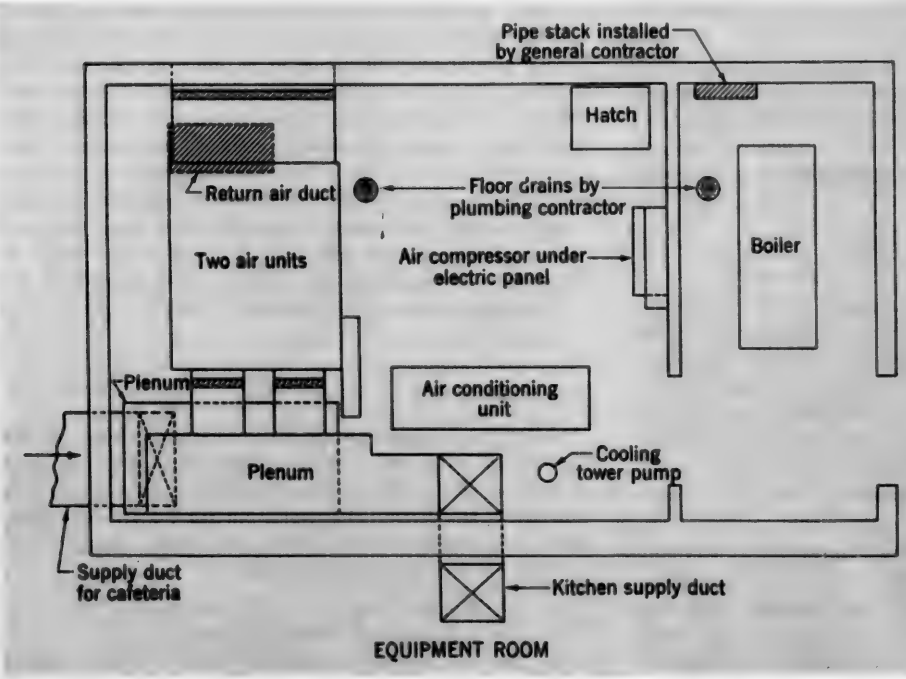
Motors used in a hermetic type sealed refrigeration compressor, operate in a refrigerant atmosphere. Manufacturers usually take advantage of this condition by depending upon the refrigerant to keep the motor within safe temperature range. These motors are usually slightly overloaded and, therefore, must be rated in amperage only and not in horsepower. This item must definitely be taken into consideration in the design of branch circuit wiring, panels, feeders, disconnect switches, and controllers.

Branch Circuits

In general, each motor must have its own and individual motor branch circuit. These branch circuit conductors must have a carrying capacity of not less than 125% of the full load current rating as indicated on the motor name plate, and must be based on the size given in Table 20, to and including Table 27, of the National Electrical Code. This would also include conductors connecting the secondary of a wound rotor to its controller.

It is well to consider the fact that 1140 or 850 rpm motors have a current rating of about 25% greater than the full load current of a 1725 rpm motor. As stated before, motor branch circuit conductors must have a minimum current carrying capacity of 125% of the motor name plate rating. Size of branch circuit protection devices is based on the KVA motor input with locked rotor and on the application and condition of operation. Locked rotor input can be obtained from the code letter listed in Table 1.

Correct size of branch circuit fuses to be used is given in Table 20 of The National Electrical Code and will



Plan of penthouse containing all equipment for a complete air conditioning system including air conditioning units, condensing unit, controls, and boiler for space heating and hot water services.

range from 300% to 150% of motor rating, again depending upon the type of application and the type of motor used. Under severe conditions, this protection can be as high as, but never more than, 400% of the name plate rating.

Fusetrons or dual element fuses, if used for protection of motor branch circuits, will under certain conditions and applications also serve as motor running protection. There are advantages in this combination as far as the initial cost of installation is concerned. The most serious objection to the use of fuses or fusetrons is the fact that anyone can replace these devices at will, with the larger or oversize unit. This voids the protection of both the wiring and the motor.

Circuit breakers, if used, are perhaps the most foolproof branch circuit protection obtainable and must range in size from 150% to not more than 250% of motor name plate rating.

Feeders

The feeder supplying a group of motors must have a current carrying capacity of 125% of the full load current rating of the highest rated motor of the group plus the sum of the full load current rating of the remaining motors. For long runs, it may be necessary to use larger conductors to avoid excessive voltage drop.

Feeder protection must be based on the branch circuit protection, as previously described, for the largest motor plus the sum of all running currents of the remaining motors. If two or more motors of equal horsepower rating are the largest of the group, one of them should be considered only as the largest for these calculations.

Motor Running Protection

Since branch circuit fuses or circuit breakers must be of sufficient size to carry the starting current of the motor, they can only serve for a protection of motor branch circuit conductors, motor control apparatus, and motors against short circuits or grounds. They will not protect motors against overload, under-voltage, or single phasing. Therefore, a motor running protective device must be installed in addition to branch circuit protection. These devices, which are responsive to motor current, are usually incorporated in the motor starters or controllers or as fusetrons in disconnect switches or power panels, and must be rated or set at 125% of the motor full load rating for motors having a temperature rise of not over 40 deg C and not over 115% for all other type motors. These devices, except fusetrons, must be protected by branch circuit fuses or circuit breakers not over four times the rating of the motor for which they are designed.

Fusetrons or dual element fuses have a fuse link element and a thermal cut-out element and can in most cases be used as a combination of branch circuit and motor running protection. As stated before, the objection to the use of these fusetrons is the ability of anyone to change them or replace a correct size fusetron with anything that will fit in the clips.

Fusetrons cannot be used for motor running protection on large fans that cannot be brought up to full speed quickly due to the delay in getting the extra heavy revolving parts up to speed. Neither can fusetrons be used for motor running protection where high ambient temperature prevails or where frequent starting of a motor is involved. Motor running protection devices are usually incorporated in most manual and automatic starters and are quite reliable. They are not as easily changed or tampered with as the fusetrons. These overload or thermal protection devices usually operate by means of dashpots, trip coils, or relays affected by current, or thermal cut-outs affected by heat in bi-metal strips or solder pots.

Means of Disconnect

Each individual motor or, in some cases, a group of motors, requires a means of disconnecting. If a switch is used, this switch must be rated in horsepower and will be required to disconnect the motor, controller, and control wiring from the circuit. These switches must be readily accessible and must be located within sight from the controller. A distance of more than 50 ft is equivalent to being out of sight.

Branch circuit protection and with fusetrons only (motor running protection as well) may be incorporated in the disconnect switch. If a circuit breaker is used as a disconnecting means, branch circuit protection only can be incorporated.

Disconnect switches for motors exceeding 50 hp in size must be rated in amperes and can be of the general use, isolated, or motor rated type. Fused switches, in addition to the required motor rating, must also be selected in rating to correspond with the size of branch circuit fuses to be used. This, in some cases, will necessitate selection of a switch that has a considerably higher horsepower rating than switches without fuses.

Rating of disconnect switches to be used in connection with hermetic type refrigeration compressors is given in Table 25 of The National Electrical Code.

Motor Controllers

As stated before, motor and type of motor controllers must be selected in conformity with the power company requirements. In addition, controllers must be rated in

TABLE I—IDENTIFYING CODE LETTERS AND KVA RANGE

Code Letter	Kilovolt-Amperes per Horsepower with Locked Rotor	
A	0	3.14
B	3.15	3.54
C	3.55	3.99
D	4.0	4.49
E	4.5	4.99
F	5.0	5.59
G	5.6	6.29
H	6.3	7.09
J	7.1	7.99
K	8.0	8.99
L	9.0	9.99
M	10.0	11.19
N	11.2	12.49
P	12.5	13.99
R	14.0	15.99
S	16.0	17.99
T	18.0	19.99
U	20.0	22.39
V	22.4	and up

horsepower, which shall not be lower than the horsepower rating of the motor which it controls.

Controllers for hermetic type refrigeration compressors must be rated in terms of full load current and in current interrupting capacity and must be selected to conform with both the name plate full load current and the locked rotor current of the compressor motor. For full load current, the rating of the controller shall be selected from tables 22 to 24, inclusive, of The National Electrical Code; and for locked rotor current, the controller rating shall be selected from Table 25. If two different ratings are so obtained, a rating at least equal to the larger of the two values obtained shall be selected.

Location of motor controllers must be within sight from the motor it controls. A distance of 50 ft is considered equivalent to being out of sight.

The wiring used for remote control or temperature control can be very extensive and, in some cases, very complicated. The size of these control wires is usually quite small and, according to code requirements, will be protected by the motor branch circuit fuses or circuit breaker only if all control devices, start-and-stop buttons, thermostats and pressure switches are all located on the same machine and the control circuit does not extend beyond this machine. If push buttons, thermostats, or other control devices are not located on the same machine, such control wiring will only be protected if the motor branch circuit fuses or circuit breaker are not over 500% of the carrying capacity of this wiring. If the motor branch circuit protection is more than 500% of the current capacity of the control circuit wiring, separate protection must be provided.

Control circuits must be so arranged that they will be disconnected from the source of supply when the disconnecting switch of the motor involved is in the open position. The disconnecting means may also consist of two separate devices, one of which disconnects the motor and controller from the source of power supply and the other, the control circuit from its power supply. Two separate disconnect switches offer an excellent means of providing fuse protection for the control wiring, if necessary. These two devices, however, must be located immediately adjacent to each other.

Interlocking of various motors, such as used on fans, compressors, pumps and cooling tower can be readily accomplished with a separate control circuit and the use of small relays, or with the great variety of special equipment or auxiliary contacts available for this purpose.

Control wiring must always be installed in raceway or otherwise suitably protected from mechanical injury and should be so arranged that an accidental ground will not start the motor.

General

So-called packaged air conditioning units in which the compressor motor or motors, as well as the fan motor and all controls, are mounted in the same factory-assembled enclosure, quite often do come completely wired by the manufacturers for one disconnect switch and one combination feeder connection only.

This condition is very undesirable and definitely not in accordance with The National Electrical Code requirements. There are at the present time no automatic line starters obtainable that have been approved for group installation. Therefore, each starter and each motor must have its own and individual branch circuit protection. Grouping of more than one motor and control on one branch circuit is not permitted in this particular case.

Nevertheless, there are a number of hermetic or open type condensing units on the market for which special permission, exceptions, and approvals for controls, equipment, motor running protection, and branch circuit wiring have been given. These exceptions are not listed in The National Electrical Code book but in a bulletin published by the Underwriters' Laboratories, Inc., covering these particular units only. All such condensing units, if approved by the Underwriters' Laboratories, Inc., are listed under "Re-examination Service." Products so listed are marked with the listee's identification and catalogue designations, or the equivalent, which corresponds with the marking shown in the Laboratories' published records. No Underwriters' label is attached to these machines; therefore, one has to refer to the Underwriters' Laboratories listings if it is necessary to check or verify approvals.

Correct size undercurrent or overheating devices for protection of all motors must be installed by the manufacturer. The name plate must indicate the maximum size of branch circuit fuses if more than one motor is operated from one supply line. Regardless of this, some cities have local electric codes or ordinances prohibiting the use of such equipment, if not wired or equipped in strict compliance with The National Electrical Code or city requirements.

Two-Motor Use

The method of determining branch circuit size and branch circuit protection has been previously discussed and is based on the size and type and number of motors used. If two or more motors must be started simultaneously, it will be necessary to install larger feeders and correspondingly larger rating or setting of feeder overcurrent protection. For instance, two 60-ampere rated motors starting simultaneously require the same amount of starting current as one motor rated at 120 amperes and of the same type and construction. Feeder and branch circuit wiring and protection must be based on those maximum requirements; however, this protection may at no time be of larger size than as previously discussed under the heading of Branch Circuits and Feeders. Therefore, the possibility may exist that a time delay relay should be installed in one of the motor control circuits to prevent simultaneous starting.

Motor and air conditioning units must always be located so that adequate ventilation is provided and so that maintenance, such as lubricating and replacing of bearings, can be readily accomplished. Safe operating temperature rise of motors is given in degrees above the room temperature in which it is located. If this room temperature is too high, the motor temperature will also be too high and will result in early failure. The capacity

of all feeders and motor branch circuits is reduced by 18% if room temperature is over 86 deg F; reduced by 29% if the room temperature is over 104 deg.

Motors operating over 600 volts, due to the additional hazards involved, require special wiring, control, and sometimes special building construction. In such cases it would be best for the designer to be guided by requirements as set forth in Article 430 of The National Electrical Code.

Air Distribution

In variety stores as in other applications, the satisfaction realized from air conditioning installation depends largely on the air distribution. It is not as critical as in a restaurant or a theater, since people are continually moving about and are not affected too much by slight local drafts.

Good distribution and comfort conditions in the store dictate approximately using six air changes per hour for the total air quantity. Initial duct velocities can be 2200 to 2400 fpm at the fan outlet. Noise is usually not a factor since the noise level in the store is higher than the usual air conditioning application for an office building or department store.

The human comfort gained by properly cooling and dehumidifying the air may be entirely offset by the discomforts resulting from extreme drafts or air stagnation. The full benefits from air conditioning can only be obtained if the temperature and air motion are uniformly maintained throughout the conditioned area. Drafty and stagnant air conditions are particularly objectionable at the cafeteria area where the occupants remain seated in one location while eating.

In the smaller stores, duct work may be unnecessary or held to a minimum if self contained air conditioners are installed and located to give proper air distribution. In larger stores, where a remote or central station system is employed, the volume of air required makes duct work essential for proper distribution.

Clean air is particularly important because the sale of merchandise depends on a clean, attractive article, and in addition the variety store is usually an eating establishment requiring clean air. Both recirculated and outside air should be filtered. Spun glass, replacement type filters are generally used because they are practical and reasonable in price. However, there are many instances where the cleanable type filter is preferred, and in the large installations, electrostatic filters have been used to some degree.

Face velocities at return air grilles should be held at a low velocity not because of noise, but for collection of dust and dirt on the face of the grilles and adjoining walls, ceilings, and display counters located in the path of the returned air. In many cases, several return air openings should be utilized to accomplish best results.

No air conditioning system is any better than the final and careful air-balancing operation, no matter how well executed the mechanical part of the system may be. A careful study of the system's design must be made and the engineer should make certain the design volumes are obtained for the various areas. Only through proper balance can maximum results and economical operation be obtained.

The matter of controls for variety type stores is most important and price can be no object insofar as the tenant's requirements are concerned. Many engineers lose sight of the fact that the personnel who from day to day has to operate the system has very little or practically no conception of mechanics. The store's personnel is selected on a basis of merchandising ability and very seldom are these people even remotely capable of understanding the function of air conditioning. The most practical system is one that is completely automatic and requires nothing more for its operation other than the simple turning of a switch which reads "Day" or "Night". This, by no means, is intended to belittle or criticize a store's personnel; these people, in their respective lines, are among the country's top operators and should be spared as much responsibility for the equipment's operation as is possible. For the aforementioned reasons, a system's control should be the ultimate in simplicity and dependability.

Two air conditioning units in the penthouse, installed one over the other to conserve space.

Control Sequence

A typical control sequence, as referred to in this article, is as follows: "The fan system shall be started manually by the Day-Off-Night switch and run continuously during occupied periods through a starting device having auxiliary contacts.

A Firestat set at 200 deg shall be located in the return air duct and shall stop the fan if the air temperature in the duct exceeds its setting. Provide a freeze protection controller with its 20-foot element fastened to the discharge face of the heating coil and wire in series with the fan starter. Should the discharge temperature leaving the heating coil drop below 35 deg, the fan will automatically shut down.

When the system is operating at the day position, the fresh air damper is energized and opens to admit the required amount of fresh air for ventilation. The space thermostat shall, on a call for heat, cause a modulating

control valve at the heating coil to modulate towards an open position so as to maintain space temperature requirements. A low limit discharge controller shall be wired into the heating circuit so that the temperature of the air being discharged to the space shall not be below 60 deg, regardless of the thermostat setting. During the cooling cycle, the space thermostat shall, upon a rise in temperature above its set point, operate the cooling system to maintain space temperature requirements by staging of direct expansion valves or modulation of chilled water coils. When the system is on a cooling cycle, the low limit discharge controller shall become inoperative. All elements of the cooling system should be electrically interlocked with the fan starter so that the cooling equipment cannot operate unless the fan is in operation.

When the Day-Off-Night switch is moved to the night position during the heating season, a night thermostat shall cycle the fan to maintain a lower night temperature. During this period the fan system shall operate with the fresh air damper closed. With the switch in the off position, the fan system and the cooling system shall be inoperative."

For the larger stores where multiple zoning is required, the same general sequence of control can be employed; it being only necessary to multiplex the controls.

Auxiliary Heating

Entrances handling heavy traffic and large see-through type window areas impose heating loads which the general design of air distribution cannot handle through the normal control system. The sales area thermostat, in many cases, will be satisfied through the lighting load and internal heat gain from people and appliances, and should not be located so as to sense the unusual conditions at the entrances and windows. Therefore, consideration should be given to the use of auxiliary heating sources such as booster coils in the duct serving the frontal area of the store, or individual unit heaters spotted strategically over the effected areas. The control of these sources should be by independent thermostats located in the effected area. Throughout the store other areas such as receiving entrances, loading docks, stock areas, rest rooms and toilets, may have to have special consideration for comfort of customers and store personnel. These special considerations can involve zoning, additional heat in-put and ventilation employing automatic thermostatic controls.

Installation and Operating Costs

Air conditioning installation costs for variety type stores is quite varied and it would be almost impossible to attempt a breakdown for a per ton or a per square foot price. The top variety store usually is the store around which shopping areas are built and special inducements are offered by landlords to attract stores which form the nucleus for a successful shopping area.

While we attempt to set up a system to function simply with a minimum of the store's personnel's time and ability, there still remains a responsibility which is strictly up to the store's management. This responsibility is the cost required to operate the equipment. For instance, special attention must be given to seasonal periods during which the equipment is placed in operation and also removed from operation. The meter reading dates for the store should be determined and caution used as to shutting down and starting up of the store's equipment. Many times equipment is operated only a few days prior to or after meter reading and heavy demand charges are imposed. The application of adequate

View of condensing unit and other related equipment, all arranged for easy access and service.

and dependable automatic controls will assure maximum benefits and minimum cost of operation. Poor and inadequate controls can and will result in excessive operating costs, destroying the store's profits.

Because of present-day methods of operation among chain-operated stores where leased properties are the rule rather than the exception, an exact cost for installation cannot be accurately determined. As mentioned previously, many times costs for a variety store's air conditioning system are divided among many other less important tenants, for the variety store is usually the major traffic source.

Since the variety type store enjoys this favorable position, it can establish the rental rates which it pays for space occupied, and for this reason much adjusting in rates is done. The aggressive variety store developers continually compare costs for various types of systems in an effort to reduce initial installation costs which have a direct bearing on rental rates. The total cost of putting a tenant in a building usually is written off over a ten-year period, since many leases are made for 10 years with renewal options of 5 to 7 years. Leases for 50 and 99 years are almost a thing of the past. This in itself is all the more reason for careful study of equipment selection. A factor which the variety store operator cannot overlook is cost of operation and maintenance of the equipment which is provided by the landlord. Among the many types of systems offered, experience has proven the centrifugal machine the most efficient and least expensive to maintain.

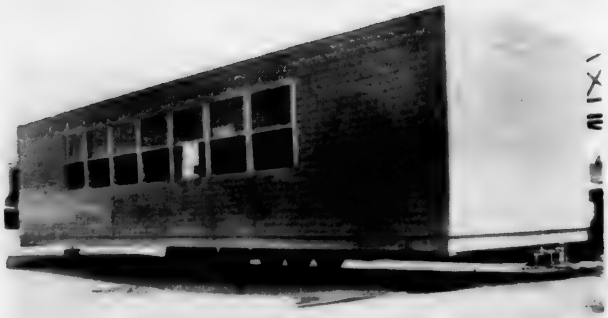
Recent developments in centrifugal designs which have reduced costs of manufacture now make it possible to consider this system for a greater percentage of stores. Due to the infinite range of capacity control inherent in the centrifugal design, costs of operation are directly governed by demands of tonnage required. Savings up to as much as 50% can be realized.

Maintenance Program

In consideration of the equipment's high cost, a definite maintenance program should be established. In many quarters it is considered that the cost of maintenance should be not less than 5% of the total cost of the equipment. Since the air conditioning equipment is a vital and important part of a store's operation, budgets should be made for its maintenance and repair and should become a definite part of the store's operating cost. With this type of planned program, sales projections can more accurately be made. To assure the equipment's proper maintenance, a contract should be made for the services of a competent service organization. Several types of service contracts are available.

Although there are various types, only a certified maintenance and replacement program is covered in this article. The certified maintenance has much to offer insofar as variety or chain-operated stores are concerned. Maintenance of the equipment is by local establishments which have remained in business even after changes of personnel in the store. Such groups have a complete knowledge of the store's equipment and the necessity for operating instruction is eliminated. The proper functioning of the equipment is (1) the responsibliity of the contractor or (2) the service company who will maintain the equipment at its peak of performance. Management is assured the full benefits of its investment and since the store manager is no longer responsible for the equipment's operation, he can devote his full time to merchandising the store. Through the certified type of maintenance program, the cost of operating the store's air conditioning equipment can be definitely established. Regardless of what befalls the equipment, even to the extent of a complete replacement, the cost will not vary, and throughout the store's entire lease term, the store will have a maximum of efficiency from its equipment. With reports furnished by the contractor at each inspection, it is possible for personnel in the main office to have a current conception of the store's mechanical equipment's performance and this reduces the need for expensive personal inspections.

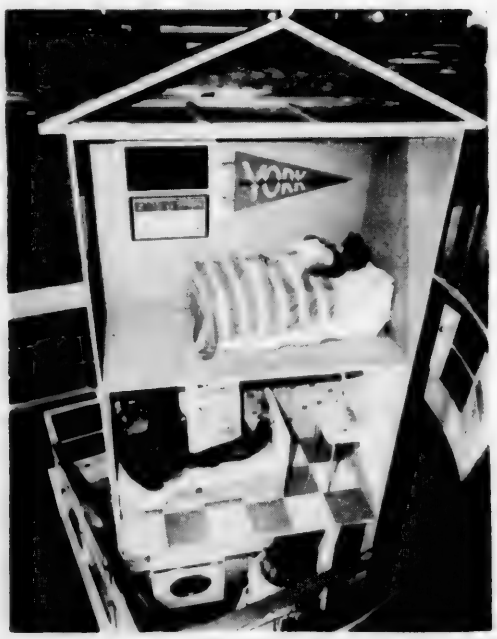
Because of the large investment involved in a variety store's air conditioning equipment, only the most competent engineering talent should be employed to design the air conditioning system. Gadgets and tricky designs should be completely eliminated and the simplest systems employed. In the case of the variety store, quality of equipment and workmanship, as it pertains to its mechanical equipment, should be of first consideration. The equipment should be dependable so that it will last through the term of the lease.



▲ MOBILE CLASSROOM AND BANK ▲ Views on left show mobile classroom built for an eastern school system that plans to use this and similar units to help ease over-crowding in schools. Accommodating 40 persons, unit conforms to state, county and local ventilating heating and wiring specifications. Photos on right show mobile bank, one of two constructed for branch office sites of Fidelity-Baltimore National Bank. Each will be air conditioned by three 1-ton units. All of these mobile units have acoustical ceilings, asphalt tile floors, and Fiberglas insulation from Armstrong Cork Co.

Picture Paragraphs

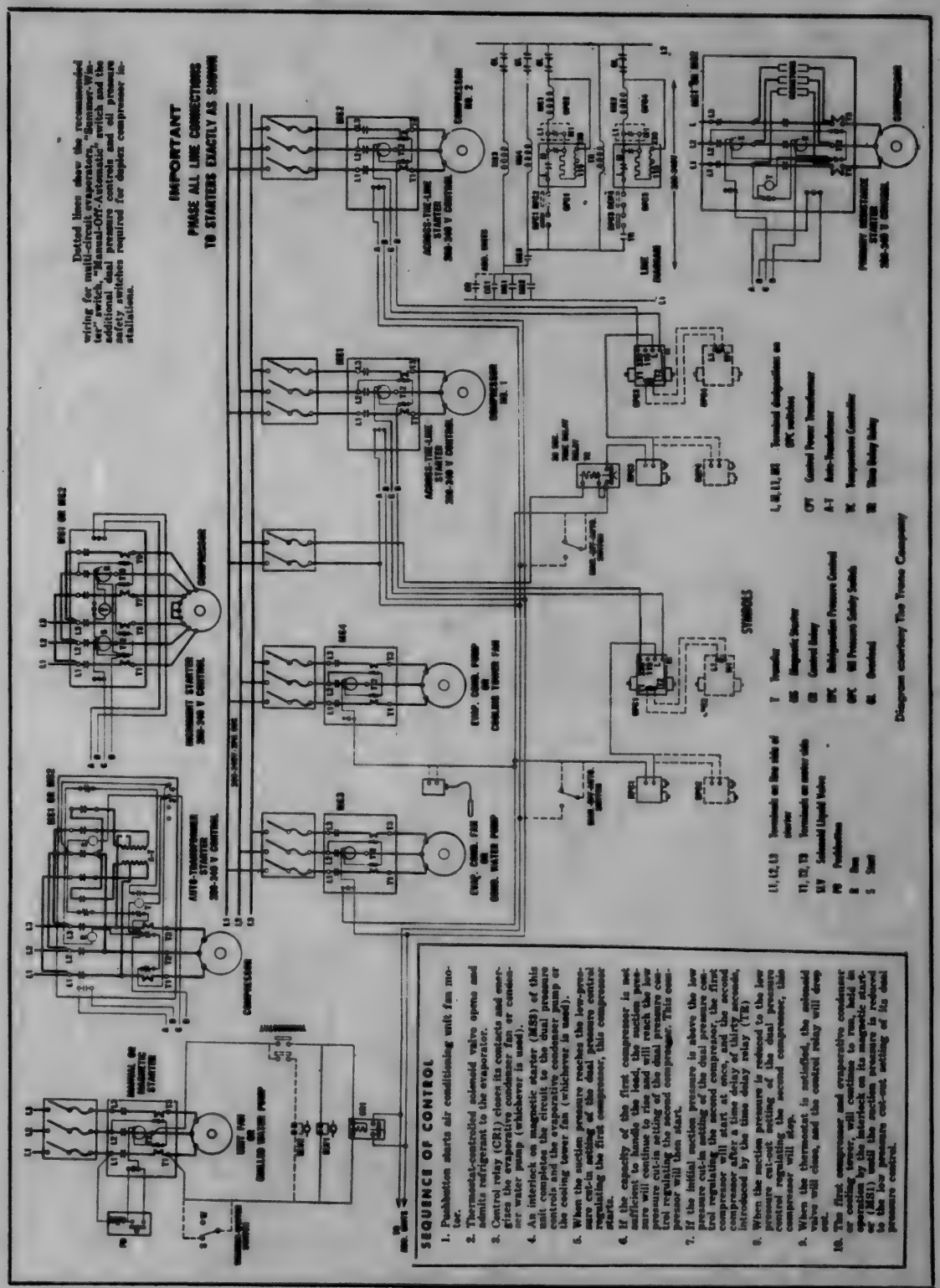
▼ TALE OF A WHALE. On a remote tributary of the Amazon, a Fabritank floats downstream carrying diesel fuel to an isolated gold dredging operation deep in the Bolivian jungle. Made of rubber-coated nylon by The Firestone Tire & Rubber Co., the 1000-gal capacity "whales", as they have been nicknamed, were originally designed for the storage, rather than the transportation, of liquids.



▲ SOME BEAR FACTS. In a 20-ft display house erected in the Borg-Warner Exhibition Hall, in Chicago, the children's story, Goldilocks and the Three Bears, is a unique setting for products of four B-W divisions and subsidiaries. Under a roof lined with Reflectal Corp.'s aluminum insulation, Baby Bear sleeps "cool" with a York window air conditioner, while Papa Bear soaks comfortably in an Ingersoll-Humphryes bath tub. In the kitchen, Mama Bear bustles about happily with her Norge appliances.

WIRING DIAGRAM—REFRIGERATION COMPRESSORS—7

Parallel Compressors, Evaporative Condenser or Cooling Tower, 208-240 Volts


IMPORTANT
PHASE ALL LINE CONNECTIONS
TO STARTERS EXACTLY AS SHOWN
SEQUENCE OF CONTROL
1. Pushbutton starts air conditioning unit fan motor.
2. Thermostat-controlled solenoid valve opens and admits refrigerant to the evaporator.
3. Control relay (CR1) closes its contacts and energizes the evaporative condenser fan or condenser water pump (whichever is used).
4. An interlock on magnetic starter (MS1) of the unit completes the circuit to the dual pressure controls and the evaporative condenser pump or the cooling tower fan (whichever is used).
5. When the suction pressure reaches the low-pressure cut-in setting of the dual pressure control regulating the first compressor, this compressor starts.
6. If the capacity of the first compressor is not sufficient to reduce the load, the suction pressure will continue to rise until it reaches the low pressure cut-in setting of the dual pressure control regulating the second compressor. This compressor will then start.
7. If the initial suction pressure is above the low pressure cut-in setting of the dual pressure control regulating the second compressor, the first compressor will start at once, and the second compressor after a time delay of thirty seconds, introduced by the time delay relay (TR).
8. When the suction pressure is reduced to the low pressure cut-out setting of the dual pressure control regulating the second compressor, this compressor will stop.
9. When the thermostat is satisfied, the solenoid valve will close, and the control relay will drop out.
10. The first compressor and evaporative condenser or cooling tower, will continue to run, held in operation by the interlock on its magnetic starter (MS1) until the suction pressure is reduced to the low pressure cut-out setting of its dual pressure control.

DETAIL SHEET—AIR CONDITIONING, HEATING AND VENTILATING

February, 1960

WIRING DIAGRAM—REFRIGERATION COMPRESSORS—8

Parallel Compressors, Evaporative Condenser or Cooling Tower, 380-550 Volts

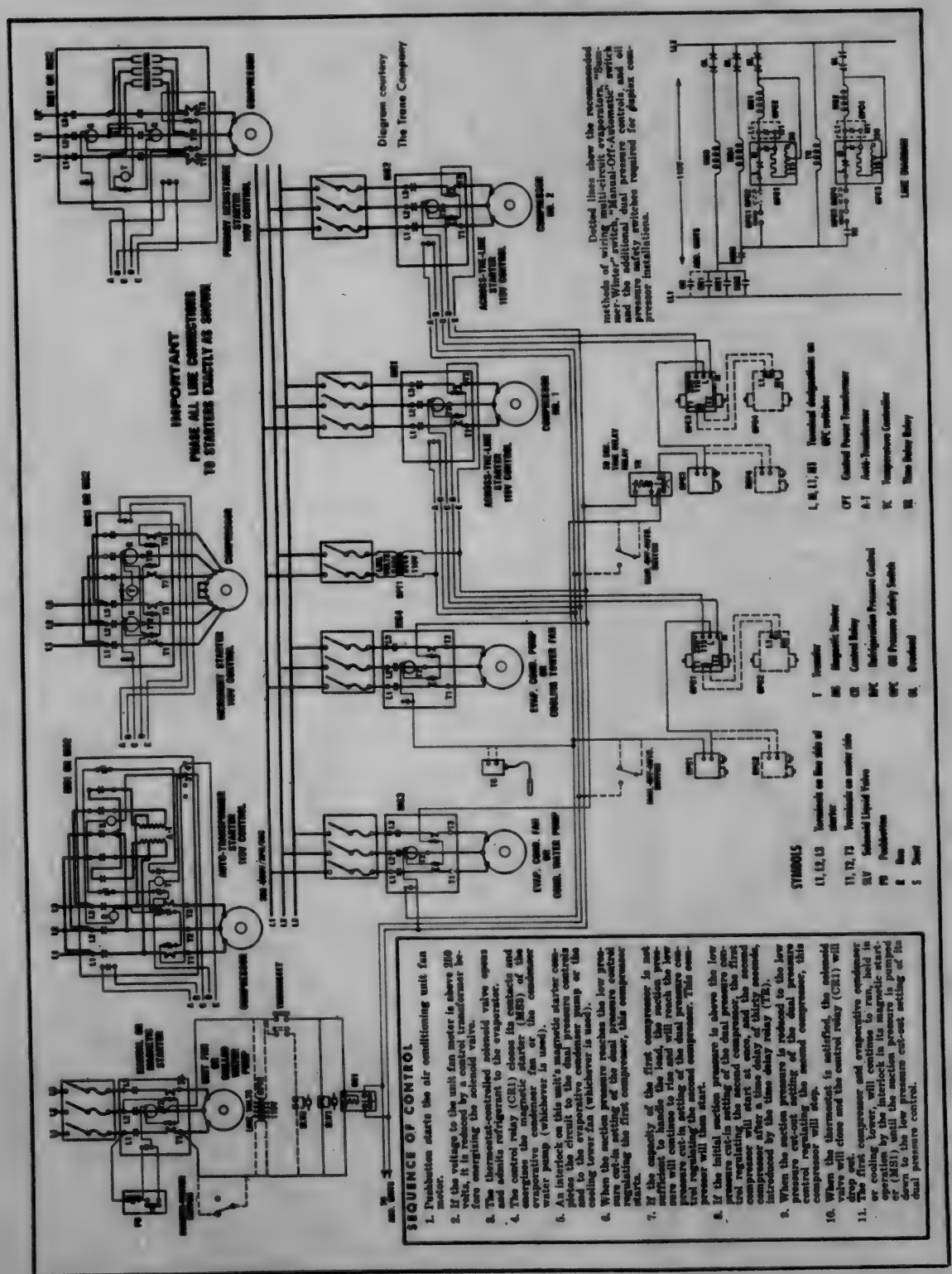


Diagram courtesy The Trane Company
IMPORTANT
PHASE ALL LINE CONNECTIONS TO STARTERS EXACTLY AS SHOWN
Dotted lines show the recommended methods of wiring multi-circuit evaporators, "Summer-Winter" switch, "Manual-Off-Automatic" switch and the additional dual pressure controls, and oil pressure safety switches required for duplex compressor installations.
SEQUENCE OF CONTROL
1. Pushbutton starts the air conditioning unit fan motor.
2. If the voltage to the unit fan motor is above 380 volts, it is reduced by a control transformer before energizing the solenoid valve.
3. The thermostat-controlled solenoid valve opens and admits refrigerant to the evaporator.
4. The control relay (CR1) closes its contacts and energizes the magnetic starter (MS1) of the evaporative condenser fan or the condenser water pump (whichever is used).
5. An interlock on this unit's magnetic starter completes the circuit to the dual pressure controls and to the evaporative condenser fan or the cooling tower fan (whichever is used).
6. When the suction pressure reaches the low pressure cut-in setting of the dual pressure control regulating the first compressor, this compressor starts.
7. If the capacity of the first compressor is not sufficient to handle the load, the suction pressure will continue to rise and will reach the low pressure cut-in setting of the dual pressure control regulating the second compressor. This compressor will then start.
8. If the initial suction pressure is above the low pressure cut-in setting of the dual pressure control regulating the second compressor, both compressors will start simultaneously.
9. When the suction pressure is reduced to the low pressure cut-out setting of the dual pressure control regulating the second compressor, this compressor will stop.
10. When the thermostat is satisfied, the solenoid valve will close and the control relay (CR1) will stop the first compressor and evaporative condenser or cooling tower, will continue to run, held in operation by the interlock in its magnetic start. er (MS1) until the suction pressure is pumped down to the low pressure cut-out setting of the dual pressure control.
SYMBOLS
L1, L2, L3 Terminals on line side of starter
T1, T2, T3 Terminals on motor side
SLV Solenoid Liquid Valve
PB Pushbutton
R Run
S Start
T Transformer
M Magnetic Starter
CR Control Relay
RPC Refrigeration Pressure Control
OPC Oil Pressure Safety Switch
OL Overload
L, M, U, H1 Terminal designations on QPC molder
CPT Control Power Transformer
A-T Auto-Transformer
TC Temperature Controller
TR Time Delay Relay

DETAIL SHEET—AIR CONDITIONING, HEATING AND VENTILATING

February, 1960

ESTIMATING GUIDE—REFRIGERATION AND AIR CONDITIONING

Continued from last month's Reference Data Sheet. Data, supplied by York Corporation, are rough estimates of 1957 costs to the ultimate consumer.

Application	Engineering Data	Pricing Guide
22. Hotels		
(a) Air Conditioning	½ ton refrigeration per room plus public spaces.	$600 to $1500 per ton refrigeration.
(b) Refrigeration (for the hotel restaurant)	250 to 350 Btu per hour per room.	$600 to $1500 per ton refrigeration.
23. Ice Manufacturing and Storage		Cost Per Ton Ice Making (Clear Ice)
(a) Manufacturing	1.6 to 1.7 tons refrigeration per ton ice. White ice—9 to 10 cans per ton with 12.1-9.9-deg brine temperature respectively. Clear ice—minimum of 12 cans per ton.	Tons/Day: 10 — Mechanical Equipment: $2745 — Insulation: $290 — Total: $3035 15 — 2460 — 270 — 2730 20 — 2160 — 240 — 2400 30 — 2180 — 190 — 2370 50 — 2080 — 185 — 2265 60 — 1985 — 200 — 2185 75 — 1890 — 190 — 2080 100 — 1890 — 155 — 2045 Prices include: storage room coils and piping; storage room insulation, doors and chutes (3-day storage); tank insulation, corkboard bottom and granulated sides; suction line covering and trap lagging; and all items in a standard ice plant with the exception of the building, sewer and outside water piping, electric wiring, panel and switchboard, and water treatment equipment.
(b) Storage	14 sq ft floor area required per ton of ice stored on end; 600 to 700 sq ft floor area per ton refrigeration.	$1000 to $1200 per ton for refrigeration system.
24. Laundry, Cleaning, Fur Storage		
(a) Fur Storage Rooms	40 deg db—40-60% rh—5 days per week; 15 deg db—weekend shock period. In lieu of definite information on furs, figure 30 Btu per cu ft of internal volume per 24 hr for product load.	For refrigeration system—$1000 to $1400 per ton. Installations vary from $0.25 per cu ft for less than 50,000 cu ft to $0.13 per cu ft for over 100,000 cu ft room volume for refrigeration system only.
25. Locker Plants		Use $80 to $85 per locker for entire project including insulation, lockers, building, property, etc. Use $25 per locker for refrigeration.
(a) Locker Room	Use 2 compressor motor hp per 100 lockers to estimate refrigeration required for locker room and freezer. Use 300-400 sq ft floor per ton refrigeration. Use 200-250 lb food per locker. Use 12 cu ft internal room volume per locker; allowance is included for evaporator and aisle space. Use 20 lb product per cu ft of volume when figuring bulk storage.	

Application	Engineering Data	Pricing Guide
(b) Freezer	Use shelf type freezer for any plant with 300 or more lockers. Use 3 lb product per locker for sizing freezer; no allowance for freezing retail frozen food or home locker service. Use 7½ lb food product per sq ft of freezer shelf area.	
(c) Aging Room	Use 3-5 lb produce per locker per day for sizing aging room. Use 0.4 sq ft floor area of aging room per locker.	
(d) Chill Room	Use 0.2 sq ft floor area per locker for sizing chill room where small quantities of pork for curing are handled; 0.5-0.8 sq ft floor area per locker where large quantities of pork for curing are to be handled.	
(e) Curing Room	Use 30 to 35 lb meat per cu ft of bin for pork curing bins. Allow 400-600 lb pork per sq ft floor area when estimating size of curing room.	
(f) Meat Processing Room	Use 0.5-0.8 sq ft floor area per locker for sizing meat processing room.	
26. Meat Packing		
(a) Bacon Slicing Room	200-300 sq ft floor area per ton refrigeration; 50-60 deg db—inside condition.	$500 to $600 per ton for refrigeration system including ductwork.
(b) Chill Room	4000 lb meat per ton per 24 hr including heat leakage. Air units sized and selected for 1 air change per min for beef, 1-1¼ air changes per min for pork, which will usually balance load requirements.	$500 to $600 per ton for refrigeration system including ductwork.
(c) Freezer Storage Rooms	Provide 1 linear foot of 2-inch pipe per 8 cu ft room volume for 0-deg rooms.	$1.40 per cu ft volume for complete installation.
(d) Quick Freezing	1 ton product per day = 1.5 tons refrigeration.	$1200 to $1500 per ton for refrigeration system.
(e) 35-Deg Storage Rooms	1 ton per 500 sq ft floor area; 5000 cu ft per ton refrigeration.	$0.15 per cu ft volume for refrigeration system, $0.30 per cu ft volume for insulation, $0.75 per cu ft volume for building construction, $1.20 per cu ft volume for complete installation.
27. Mortuaries		
(a) Funeral Parlors or Homes	Typical residential type with basement and 2 floors, approximately 10-20 tons; 80 deg db—50% rh inside conditions. Low noise level required.	$800 to $1100 per ton for complete bill of material.
(b) Morgues	35-40 deg inside temperature; ½ hp installation required for 3 cadavers.	$800 to $1000 per ton for complete bill of material.
28. Offices		
(a) Private	Standard comfort conditions and low noise level; 200-400 sq ft floor area per ton.	$600 to $1200 per ton for complete bill of material.
(b) General	Standard comfort conditions; 200-400 sq ft floor area per ton.	$600 to $1200 per ton for complete bill of material.
(c) Medical	Standard comfort conditions—50% outside air; 150-250 sq ft floor area per ton.	$600 to $1200 per ton for complete bill of material.

(Concluded next month)

Applying Weather Data to Crop Drying

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A method for establishing useful design criteria for drying agricultural crops is established. It provides a basis upon which weather data are used to predict future performance with some degree of confidence.

IN operations which may extend over periods ranging in length from one or two days to several weeks, outdoor air is forced through forage or grain, reducing its moisture content to the level at which it can be safely stored.

The rate of air flow, Q required for the drying operation depends on many factors but can be satisfactorily expressed in terms of two variables:

$$Q = \frac{M}{\Delta W}$$

M, the rate of moisture removel from the material, is governed by the total amount of moisture that must be removed and the time which can be allowed for drying without danger of product deterioration.

ΔW is the increase in specific humidity of the air, its so-called drying capacity, when passed through the material. It depends on the initial condition of the air, and the character of the humidification process. The latter is often influenced by heat of respiration given off by the products[1,2] and by variation in the heat required to vaporize the moisture.[3]

However, for the general case, and for the practical case in which these variables cannot be evaluated, the assumption of adiabatic humidification at constant wet-bulb temperature is appropriate. Further, agricultural products are generally hygroscopic, therefore drying air tends to absorb moisture until it reaches an equilibrium relative humidity,[4,5] a value which is characteristic of the material being dried and varies with its temperature. This limits the specific humidity which can be reached by the air in an adiabatic process.

The initial condition of the air is a weather variable. As such it can be studied by referring to appropriate meteorological records. Figure 1 illustrates how the drying capacity of air varies from year to year based on an analysis of records from one Canadian, and one U.S., station. July records were analyzed for each year separately. Using bi-hourly readings of air condition, approximate values of overage drying capacity of the air for adiabatic humidification to 85% rh and 100% rh were found for 31-day intervals. These values were plotted to show the percentage of years in which a given drying capacity, measured in pounds of moisture per pound of dry air, was exceeded.

Thus, a dryer located at Toronto, operating for the entire month of July, could be expected, on average, to remove at least 0.0014 lb of water per lb dry air, if saturated on leaving. Further, if a design drying capacity of 0.0017 was selected, which value is seen to be equalled or exceeded about 70% of the years, it would be expected that in the remaining 30% of the years the drying time would exceed the specified value by an amount ranging up to about 20%.

Use of a greater number of years of record would be likely to change somewhat the locations of the terminal points of these curves, and would increase the confidence that could be placed in them.

The size of year-to-year fluctuations in drying capacity depends on the length of the analysis time interval, because of the effects of short term weather extremes. For example, the effect of one or two hot, dry days will have less effect when part of a 31-day interval than when part of a 5-day interval. As a result, the observed maximum and minimum drying capacities found by studying a number of years of records become more extreme as the analysis time interval is decreased. This is illustrated in Fig. 2, where maximum and minimum values for 31-day, 11-day, 5-day, and 1-day intervals are plotted. The values for the 31-day interval in Fig. 2 are the terminal values in the humidification-to-100% curves in Fig. 1.

Maximum and minimum values of drying capacity (particularly the minimum) are the most important criteria for selecting a design value for the drying capacity. The most informative values of these variables can be found by using an analysis time interval that is about the same length, and falls at about the same time of year as the proposed drying operation.

For many stations, data are published for four synoptic hours, (that is, at four times of the 24-hr day at 6-hr intervals). Therefore it may be tempting to base an analysis on 6-hr, rather than one or 2-hr intervals. This is a form of spot-checking and some accuracy is sacrificed by using the longer intervals.

By way of illustration, dry bulb and wet bulb tem-

[1] Superscripts refer to references at the end of this article.

Fig. 1. Plot showing percentage of years that 31-day average drying capacity of outdoor air equalled or exceeded a given amount. Values are for adiabatic humidification to 85% rh and 100% rh. Records for Toronto: July 1941-58 inclusive; for Grand Island: 1946-58 inclusive.

Drying capacity was not calculated separately for each observation. Some accuracy was sacrificed in the interest of a very large saving in labor by averaging wet-bulb depressions for American data and dry-bulb temperatures and specific humidities for Canadian data.

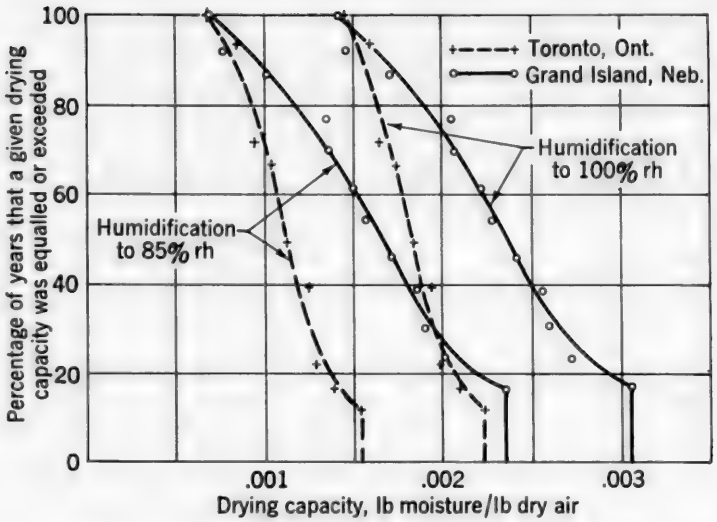


Fig. 2. Maximum and minimum average drying capacities obtained from a number of years of records for one-day (16th of the month) — 5-day (14th to 18th) — 10-day (11th to 20th) — 16-day (8th to 23rd) — and 31-day intervals. Same weather records as in Fig. 1. Drying capacity was based on adiabatic humidification to 100% rh.

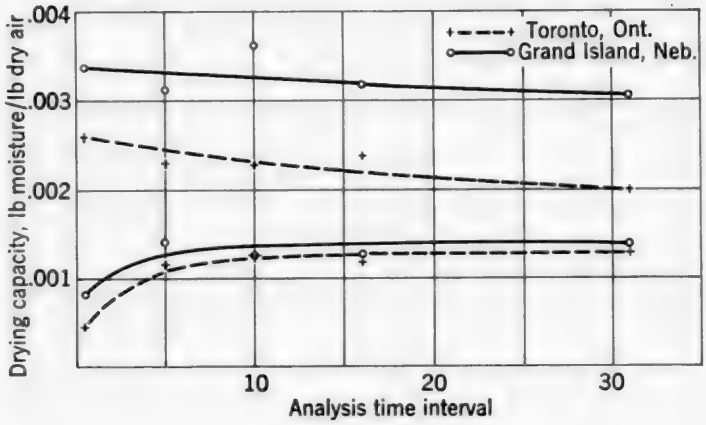
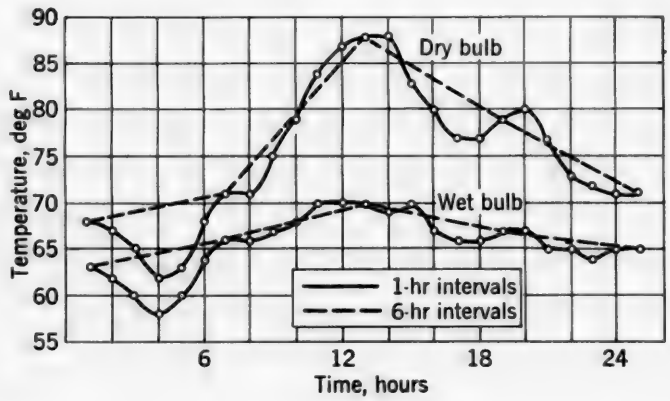


Fig. 3. Plot of dry-bulb and wet-bulb temperature for July 1, 1958, Toronto, for one-hour and 6-hr intervals.



peratures are plotted for one-hour and 6-hr intervals in Fig. 3. It is seen that the curves are considerably different and some error would be expected if the six hour values were used.

Using these data, the average drying capacity for the 24-hr. period, corresponding to adiabatic saturation, was 5% more for the 6-hr intervals than for the 1-hr intervals. Similar calculations for fifteen other randomly picked days at Grand Island and Toronto showed errors ranging from +25% to −10%, with an average value of less than +5%.

References

1. Hendrix, A. T., Heat generated in chopped hay and its relation to drying effect, Ag. Engr. Jour. 28, 286-288, 1947.
2. Milner, M. and Geddes, W. F. Biological and chemical factors involved in the spontaneous heating of soybeans, Cer. Chem. 23, 449-470, 1946.
3. Johnson, H. K. and Dale, A. C., Heat required to vaporize moisture, Agr. Eng. Jour. 35, 705-709, 714, 1954.
4. Coleman, D. A. and Fellows, H. C. Hygroscopic moisture in cereal grains, Cer. Chem. 11, 275-287, 1925.
5. Dexter, S. T. et al. Equilibrium moisture content of alfalfa. hay, Agr. Eng. Jour. 28, 295-296, 1947.

Improving Piping Hookups for Refrigerant Discharge Lines

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A discussion of the design problems encountered with refrigerant discharge lines, and pointers of what can be done to improve operation through changes in piping layout. This is the fifth article of a series on refrigerant piping.

MANY problems involved in the design of refrigerant suction lines are also encountered with discharge lines, although the solutions are not nearly so severe as with the suction lines. Lower gas riser velocities can be tolerated in moving oil to a higher elevation because of higher temperatures, keeping the oil more fluid, and the inherently higher mass flows of gas per line size. However, there are circumstances where oil movement through vertical risers may be a problem for reduced load operation and, therefore, means must be provided to keep the oil from collecting in the discharge line.

Refrigerant condensation in discharge lines, while the system is operating or idle, may be a problem. Precautions should be taken, where necessary, to prevent refrigerant condensate from draining to the compressor top heads and/or crankcase. Excessive refrigerant liquid collected in the top heads may:

1. Leak through the cylinder discharge valves to the cylinder chamber causing extremely high hydraulic pressures when the compressor is started.
2. Collect in the discharge plenum where the startup of the compressor will generate extremely high pressures in attempting to force the large quantity of liquid through the restricted plenum outlet connection.

Drainage of refrigerant condensate to the compressor crankcase of an idle compressor can be harmful or can create a nuisance. With a large concentration of refrigerant liquid mixed with the lubricating oil, the compressor oil pump may become vapor bound and may stop circulating oil. With no oil failure protection, the compressor would heat up and become damaged; with the oil failure switch working properly, nuisance shutdowns would be encountered, causing discomfort in the conditioned space or possible spoilage of food on a refrigeration system.

Compressor Connections

Figure 1 illustrates two poorly designed arrangements of discharge piping from parallel compressors. Arrangement *A* should be avoided for several reasons:

1. The downstream compressor discharge line enters the bottom of the common header and when this compressor is idle, oil may drain to it and collect in the top heads.

2. Even if the downstream compressor were always operated as the lead machine, any oil collected in the common horizontal header would be free to drain to it whenever it is not operating.

3. The rather rigid piping interconnecting compressors will have little flexibility and may result in excessive discharge line vibration and transmission between compressors and to other parts of the system.

Arrangement *B* is objectionable in several ways. With either compressor operating and the other idle, oil leaving the operating compressor will attempt to flow through a straight path at the common tee connection and will collect in the idle compressor top heads. Butting the two discharge lines together also sets up gas pulsations due to the opposing gas flows. This will result in excessive pressure drop, noisier operation, and greater line vibration. The rigid connecting line between compressors will also cause more line vibration.

The arrangement illustrated in Fig. 2 is much preferred over the other arrangements. Note that each individual compressor discharge line loops above the common header before joining it, with all horizontal runs pitched away from the compressors. In this way, oil pumped by one compressor cannot return to another idle compressor. Furthermore, any condensation in the discharge lines, except that at each individual compressor riser, will drain away from the compressor. The small amount condensed in the individual risers can generally be re-evaporated by the electric heater in the compressor crankcase, which is energized during the off cycle. By providing the elbows shown, the piping network becomes more flexible with a reduced likelihood of the transmission of excessive vibration.

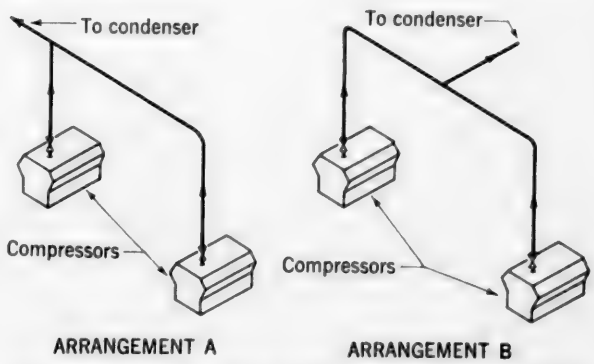


Fig. 1. Examples of poorly designed discharge line piping to parallel compressors.

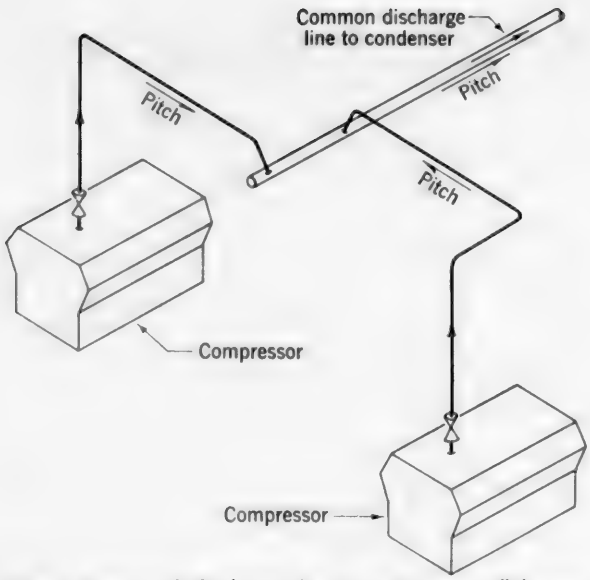


Fig. 2. Improved discharge line piping to parallel compressors.

Discharge Line Risers

Where a shell and tube condenser is used on the high side of a system, long discharge line risers are seldom encountered. Evaporative condensers and air cooled condensers, however, are frequently located on the roof of a building, with the compressors at some floor level at a lower elevation. For a single compressor system, with only one or two steps of capacity reduction, oil movement through the vertical riser will not generally be a problem if the riser is properly sized. When a compressor with many steps of capacity reduction or multiple compressors are used, operation at low load conditions may result in oil collection at the bottom of the vertical riser due to low gas velocities. This is particularly a problem on heat pump systems where the gas riser must be sized for winter duty as a suction line; this greatly oversizes the line for discharge gas flow for operation during the summer cycle.

When such a system contains a discharge line oil separator, locating the separator adjacent to the riser will generally eliminate this problem. It should be kept in mind that no separator is 100% efficient and that continuous operation at reduced load conditions will permit a large accumulation of oil beyond the oil separator, if improperly installed. Locating the separator as near to the riser as possible, will limit the oil storage volume of the line at the bottom of the riser.

Where an oil separator is not used, and low riser velocities are encountered, the arrangement shown in Fig. 3 can be used. A small loop has been provided at the bottom of the riser, and the entire length of horizontal discharge line is pitched in the direction of the loop. A ¼-inch O.D. bleed line connected to the bottom of the trap will generally be ample to drain oil away from this location if it is returned to the low pressure side of the system. To prevent excessive gas flow through the bleed line, which could penalize the capacity of the system, a small orifice protected by a strainer, should be located in this line. The orifice is sized to pass the maximum flow of oil expected while limiting the gas flow to a negligible amount.

If an oil receiver is located on the system, the oil should be returned directly to the oil receiver. Without a receiver, it may be returned to the suction line or, for a single compressor installation, directly to the compressor crankcase.

Another arrangement is to provide a small float drainer at the loop beneath the riser and let oil be returned through the float to the low pressure side of the system. On a system with a high oil pumping rate, this may be advantageous since a large diameter opening may be required to pass the maximum oil flow. The float valve can close when the liquid seal is broken, to prevent excessive gas bypass to the compressor suction line. For either arrangement, where condensation may occur in the riser during the off cycle, a solenoid valve in the return line

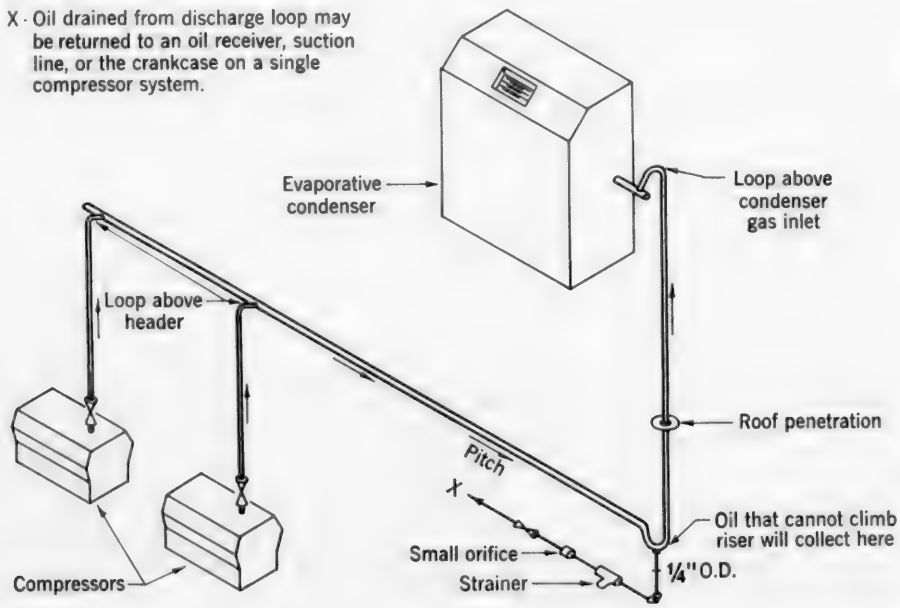

X - Oil drained from discharge loop may be returned to an oil receiver, suction line, or the crankcase on a single compressor system.
Evaporative condenser
Loop above condenser gas inlet
Loop above header
Roof penetration
Pitch
X
Oil that cannot climb riser will collect here
Small orifice
Strainer
¼" O.D.
Compressors

Fig. 3. Oil return from low velocity discharge line riser.

will be helpful to prevent drainage of refrigerant liquid to the compressor.

Note that each compressor riser is looped above the common discharge header to prevent oil drain-down during shutdown. Also, the common vertical riser to the condenser on the roof is looped above the gas inlet to the condenser. This is provided both to prevent oil drain-down during operation and to prevent refrigerant condensate drain-down when the system is inoperative.

Condensation in Oil Separators

Figure 4 illustrates another troublesome problem which is likely to occur on multiple compressor installations where each compressor is equipped with a discharge line oil separator. When one compressor is operating and another is idle, the large amount of separator surface exposed to the surrounding air will cause refrigerant condensation. This will automatically drain to the compressor crankcase with the piping arrangement shown. With one compressor idle and another operating, the condensing temperature may be 105 deg F. Since no gas is flowing through the separator to the idle compressor, the gas in it will give off its heat to its surroundings by convection and radiation. In an 80 deg ambient equipment room, the gas would attempt to approach 80 deg, but will condense when its temperature falls below 105 deg. Consequently, condensate will form and drain to the idle compressor crankcase at a rate which may exceed the distilling capacity of the crankcase heater, if provided. Then when the compressor is again started, the refrigerant mixed with the oil may cause inadequate lubrication, resulting in compressor shutdown due to the safety control.

One means of eliminating the condensation problem is illustrated in Fig. 5. Check valves are provided in each compressor discharge line downstream from the oil separator and as close to the common header as possible. Equalizing the compressor discharge line to the suction

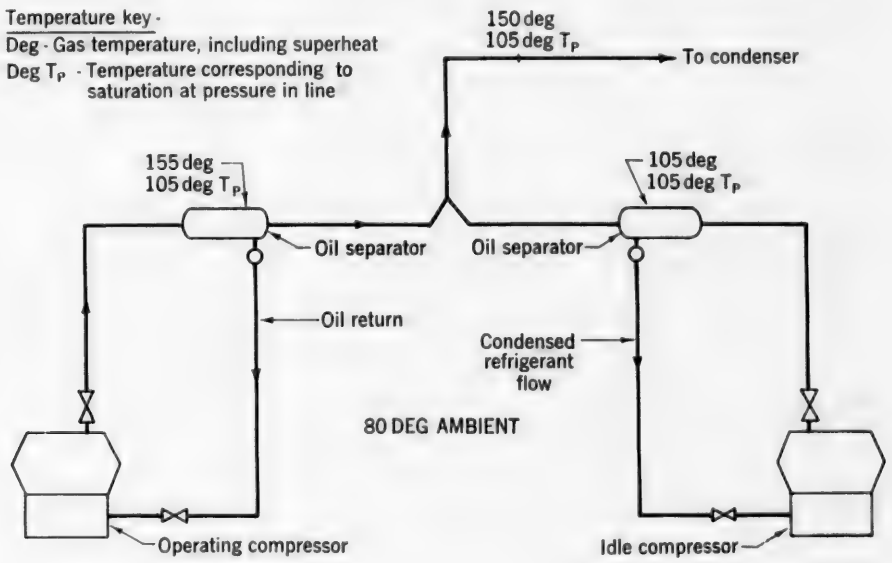


Fig. 4. Refrigerant condensation in idle discharge line oil separator.

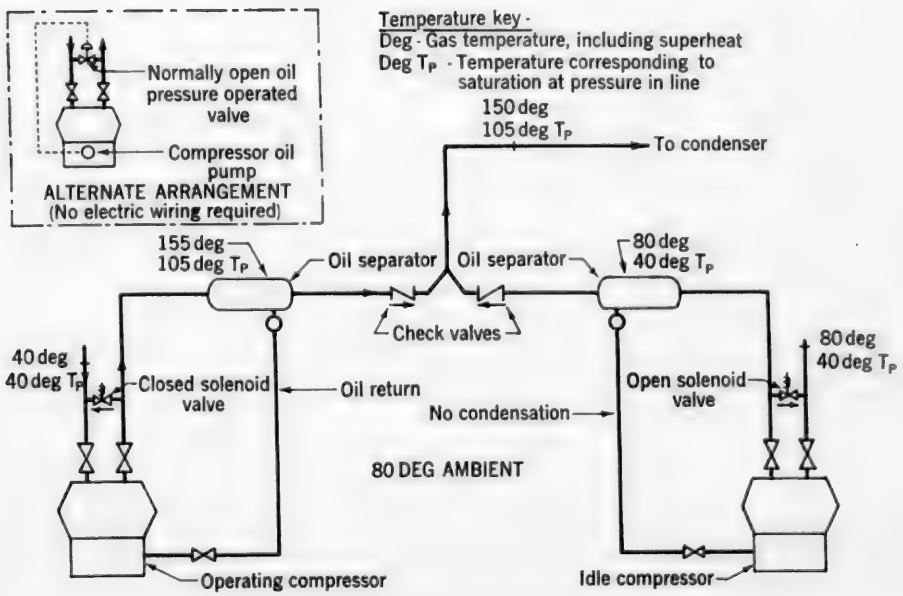


Fig. 5. Use of check valves to eliminate condensation in idle oil separator.

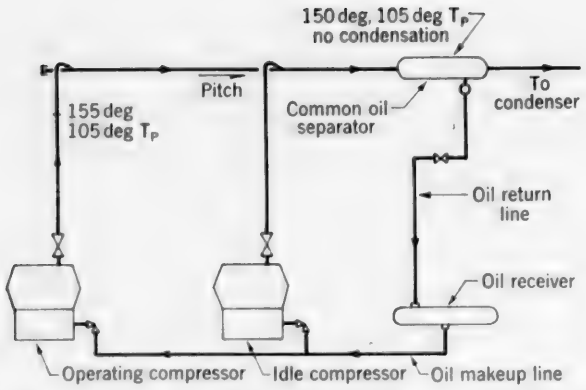


Fig. 6. Use of common discharge line oil separator eliminates condensation.

line, when the compressor is idle, will lower the pressure in the oil separator and in the individual discharge line. The check valve will prevent back flow from the operating compressor discharge. With the oil separator equalized to suction pressure, the pressure of the gas will be at a corresponding condensing temperature lower than the ambient temperature and no refrigerant condensation will take place. When the compressor again comes on the line, the equalizing valve is closed to prevent gas bypass to the compressor suction. The equalizing valve may be a small solenoid valve which can be wired in series through an interlock of the other compressor motor starter and through a normally closed relay contact of its respective compressor motor control circuit. Then if both compressors are shut down, both solenoids will be deenergized and in a closed position. If one compressor is operating, its starter interlock will energize the equalizing solenoid valve to the other compressor which can only be deenergized by operation of the second compressor.

A more economical arrangement is shown in the detail in Fig. 5 wherein no electric wiring, relays, or interlocks are required. By using a normally open, oil pressure operated valve, with the diaphragm connected to the discharge side of the compressor oil pump, the valve will remain open and will permit gas line equalization unless the compressor is operating. When the compressor is operating, oil pump pressure will close the valve to prevent gas bypass. Another advantage to the use of the discharge line check valves and gas equalizers is that normal starting torque compressor motors might be used where high torque motors might otherwise be required.

When a multiple compressor installation includes an oil receiver, individual discharge line oil separators need not be furnished, but a single separator may be provided in the common discharge line. This is illustrated in Fig. 6. Note that no additional provisions are necessary to prevent refrigerant condensation in the oil separator. If one compressor is operating and another is idle, the highly superheated gas from the operating compressor will maintain the separator at a sufficiently high temperature to prevent condensation.

Receiver Location

Another problem encountered with discharge lines is the result of locating the refrigerant high pressure receiver on the roof of evaporative condenser and air cooled condenser installations. If the discharge line is in a lower ambient temperature than the high pressure receiver, heat absorption at the receiver will vaporize refrigerant which can condense in the colder discharge line when the system is not operating. This is particularly a problem where the receiver is located where sun can shine directly on it. This is illustrated in Fig. 7. The surface temperature of the receiver, depending upon the latitude, may approach 140 or 145 deg, wherein the discharge line may be located in an 80 deg ambient. Considerable refrigerant migration will occur under such circumstances, draining liquid refrigerant to the compressor top heads and/or crankcase. Insulating the receiver or painting it with a reflective coating will only reduce the migration per unit time. In other words, there will still be heat flow into the receiver and it will merely take longer for the receiver charge to migrate to the discharge line.

Locating the high pressure receiver in a shaded area will be helpful, but again the refrigerant migration will be a function of the temperature difference between the discharge line and the receiver. With the discharge line in an 80 deg ambient, the receiver, located on a shaded portion of the roof, will at least approach the outdoor air dry bulb temperature and will likely be even warmer because of convection currents flowing off the hot roof and radiation from surrounding objects.

The best method is to locate the high pressure receiver in the same room with the discharge line so they will both be at equal temperatures and no refrigerant migration will be effected. The temperature of the coil located outdoors, if permitted to drain freely, should have no effect on refrigerant migration during the off cycle during the summer. The high temperature of the coil exposed to the sun will merely superheat the refrigerant gas, since all the liquid should be in the receiver at the lower elevations.

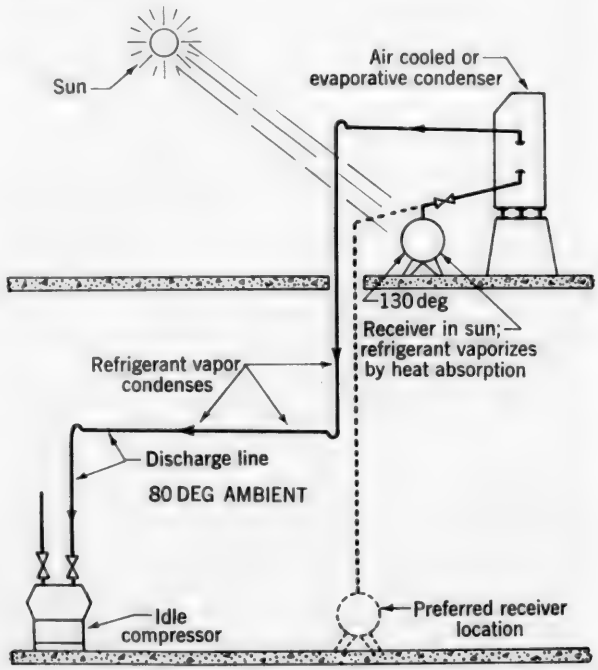


Fig. 7. Refrigerant migration due to sun effect on high pressure receiver.

LOUIS BLENDERMANN ON

PIPING AND PLUMBING

Cleanouts for Underground Drainage Lines

WHENEVER drainage lines are installed underground in a building, one must always anticipate that stoppages will occur in these lines. Stoppages can be caused by foreign objects such as bits of cloth, pieces of newspaper and accumulations of grit and grease. Therefore, some means of access must be provided in the piping system to permit the clearing of blocked lines.

Since the concrete floor slabs, floor finishing and floor construction, in general, vary considerably in each building, it is important that the type of device selected will be most suitable for each condition.

Application

Figure 1 shows a typical riser diagram in a building and suggests locations where cleanouts may be placed at the lower floor level in the building. Soil, waste and storm water lines are included in the diagram. The cleanouts consist of the building trap and devices placed along the underground run and at the base of the soil stacks. Also included are the running traps placed at the base of the leader stacks.

The underground drainage line shown is a combination sanitary and storm drain line. When this combination system is used, it is vital that traps be placed at the base of the leader lines to intercept objects that find their way into the roof drains through children's pranks or other means.

It is a recommended practice to separate the sanitary and storm drainage lines in a building to eliminate any danger of flooding the lower floor level in the building as could occur when a stoppage develops in a combination line during a rain storm.

Location of Cleanouts

Cleanouts should be placed at least every 40 to 50 ft apart on a run of underground piping and should be placed at every change in direction of the underground piping. These are the minimum needs. The engineer must place the cleanouts at locations where he believes they can best offer access to all portions of the underground drainage line. It is always good practice to check with local codes for requirements in placing cleanouts.

Types of Floor Construction

There are many types of floor construction at the lower floor level in a building and for each there are suitable cleanouts, available to satisfy each particular type. Types of floor construction are shown in Fig. 2.

Type *A* represents an ordinary concrete floor slab which is most commonly used at the lower floor level.

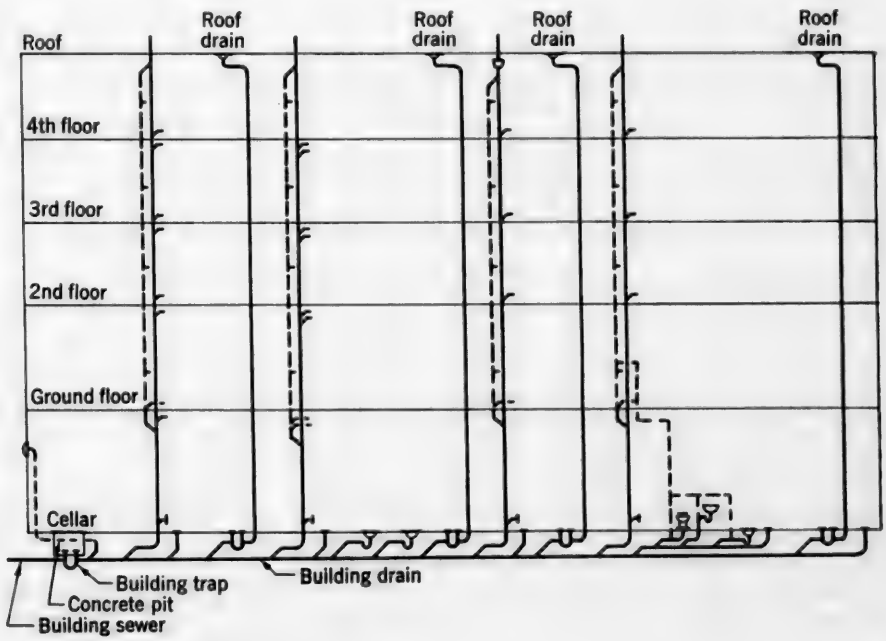


Fig. 1. Riser diagram showing the location of cleanouts for the lower floor level in the building.

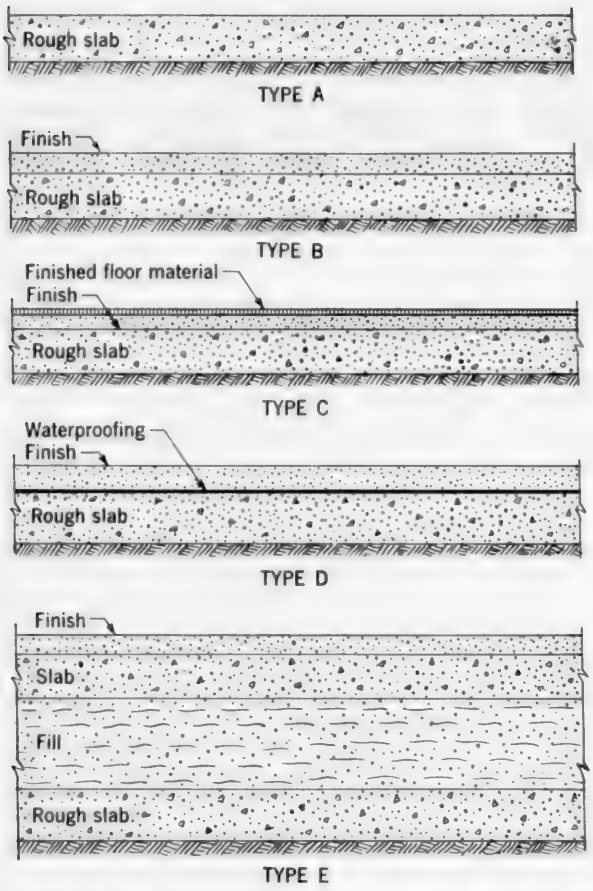


Fig. 2. Several types of floor construction that may be used in the lower floor level of a building.

Type *B* represents a floor slab with a smooth finish of concrete applied as the top surface. This is done when a smooth and level finish is desired at floor level.

Type *C* represents a floor slab with a final finish consisting of ceramic tile, asphalt or synthetic tile, or other forms of finished floor surfaces.

Type *D* illustrates a concrete slab, a layer of waterproofing and a finished layer of concrete applied to the top of it. This type of construction is used when ground water or damp conditions exist under the slab.

Type *E* depicts a floor construction that includes a concrete slab, a layer of fill and then another slab on top or a slab and a layer of finish on top. This type of construction is needed often for a specialized condition.

Building Traps

The building trap is actually a cleanout as well as a device that prevents the intake of sewer gas into the interior piping system. The cleanout offers access to the building sewer line between the building and outside street sewer facilities. Variations in the installation of building traps is shown in Fig. 3.

Detail *A* illustrates a building drain with cleanout extensions to the finished floor level. The cleanout extensions should not exceed 12 inches in length. Access is difficult when the extensions are longer than 12 inches, especially with regard to a building trap.

Detail *B* shows a building trap that is placed at a lower elevation. In this case, a concrete pit is constructed to permit access to the cleanout plugs.

Variations, as well as other types of installations may be utilized with equal success since the principle of providing cleanouts is rather similar in each one.

Methods for Installing Cleanouts

Since a wire snake or specialized line clearing device must be inserted throughout the cleanout and into the drainage line, the cleanout piping must be arranged to facilitate operation of the apparatus. Figure 4 shows several different methods for installing the cleanout piping to facilitate this task.

Method No. 1 shows the use of an $\frac{1}{8}$-bend that terminates at the finished floor level. If the drainage line were buried deeper, then a short extension could be placed into the $\frac{1}{8}$ bend to extend the cleanout up to the level of the floor.

Method No. 2 shows an installation that utilizes an $\frac{1}{8}$ bend with an extension between it and the TY fitting.

Method No. 3 illustrates an end of the line cleanout where an $\frac{1}{8}$ bend may again be employed.

Method No. 4 shows an end of the line cleanout that features a vertical piece of pipe and a long turn ell.

Other methods may be used instead of these illustrated but the important point to remember is that the piping should be so arranged that the wire or apparatus can be inserted into the piping in the direction of the flow in the drainage line. Thus the wire snake or apparatus can be manipulated without the danger of kinks or bends in the wire or apparatus.

Although not shown, cleanouts with a recessed or coun-

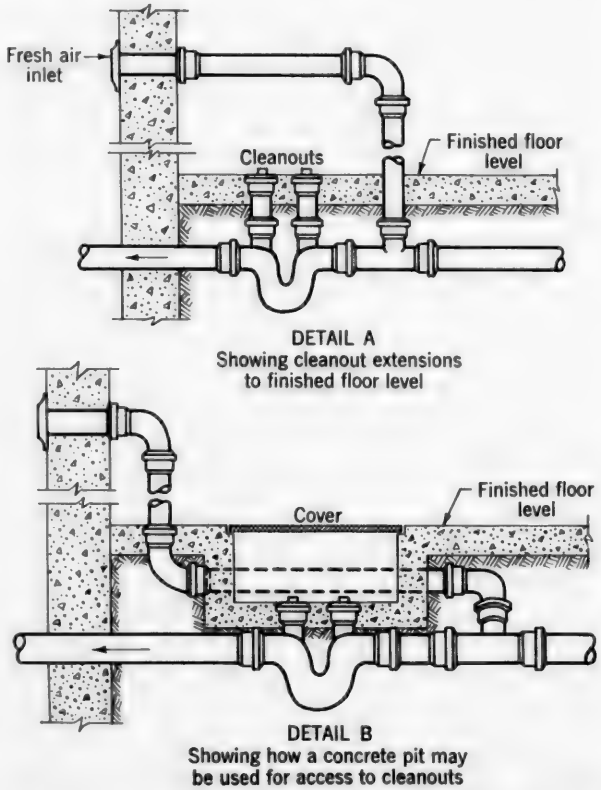


Fig. 3. How building traps may be installed for clearing stoppages in the house sewer.

tersunk socket have been used so that a projection will not be evident at the floor level.

Types of Cleanouts

Three of many different types of cleanouts available are shown in Fig. 5.

The first type is the exposed cleanout which can be used in areas where appearance is not a factor. Either a raised head or countersunk type plug has application in this location.

The access box offers a neat appearance and is ideal where floor finishes are applied. Furthermore, it affords a durable surface over which heavy traffic loads may pass without imposing a strain on the cleanout itself. The access box is easily set in place over the cleanout before the finished flooring is applied. Once the finish is added, the box is anchored securely in place.

While the concrete pit is desirable for certain appplications, it is often more costly to provide the pit and cover than to install one of the manufactured devices.

Finished Flooring

Sometimes the drainage piping will be located below a corridor at the ground floor level in a building. When the finish in the corridor is of such a nature that cleanouts would be objectionable, the cleanout can then be installed as indicated in Fig. 6. Here the piping is installed so the cleanout is set in the wall above the floor level.

There are many variations for this type of installation and the arrangement in Fig. 6 is merely one method.

Cleanout Plugs

The basic cleanout is a plug which, when it is installed in a ferrule or threaded connection, offers a watertight and gastight fit. This plug must be easy to remove to provide access to the drainage lines. Several different plugs as well as applications are shown in Fig. 7. There are the regular cleanout plugs of which there are two types. One is the raised head plug while the other is the countersunk plug. These may be constructed of brass, cast iron or other approved materials.

Lead seal cleanout plugs include the raised head and countersunk type plugs. This type of plug is equipped with a tapered flange that will seat against the lead poured in the hub of a length of soil pipe. The purpose of this innovation is to provide a connection that will not rust or freeze in place and thus can always be easily removed and replaced, when access to the drainage lines is needed.

Ferrules are the components of cleanout plugs. Illustrated are the ferrules that may be used with the regular and lead seal type cleanouts. Soil pipe hubs are shown dotted to indicate how the installation will look when the plug and ferrule are added.

In addition to the cleanout plugs and ferrules, there are many variations in manufactured devices for cleanouts to fit any specific construction need.

The extension cleanout is an example of this type device. It is very helpful because it fits into the hub of

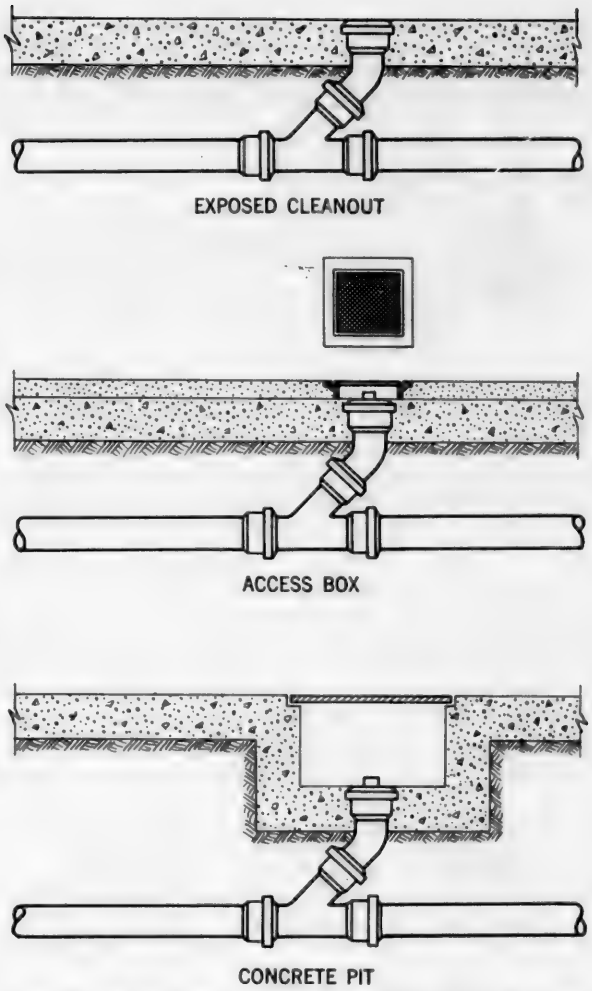


Fig. 5. Methods for providing cleanout access to underground drainage lines.

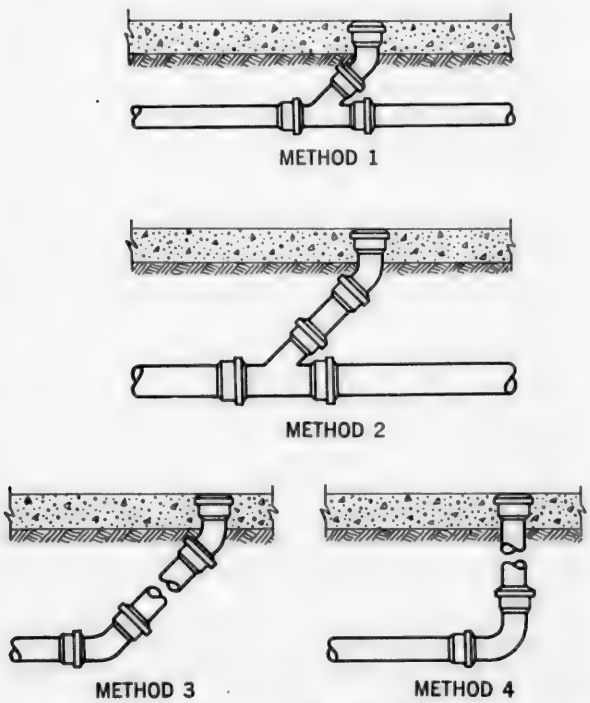


Fig. 4. Methods for extending cleanouts up to the finished floor level.

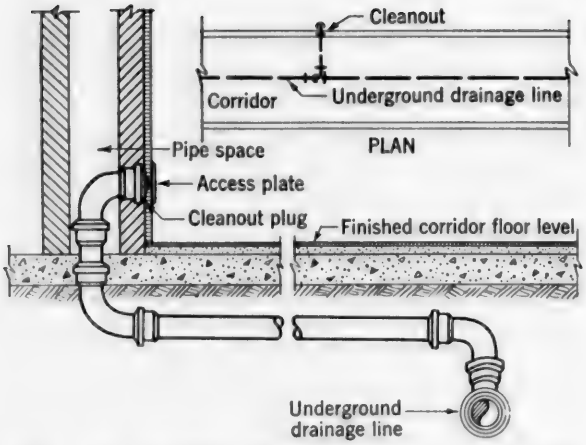


Fig. 6. How a cleanout may be offset and installed above the floor when it is desired to keep the floor surface clear of such devices.

soil pipe and can be cut to any desired length to satisfy the prescribed limitations of construction and terminate at the floor level.

The extension cleanout with housing is a unique device because it allows the cleanout cover plate of the housing to be installed level with the finished floor. However, since the housing is free of the extension, a certain amount of

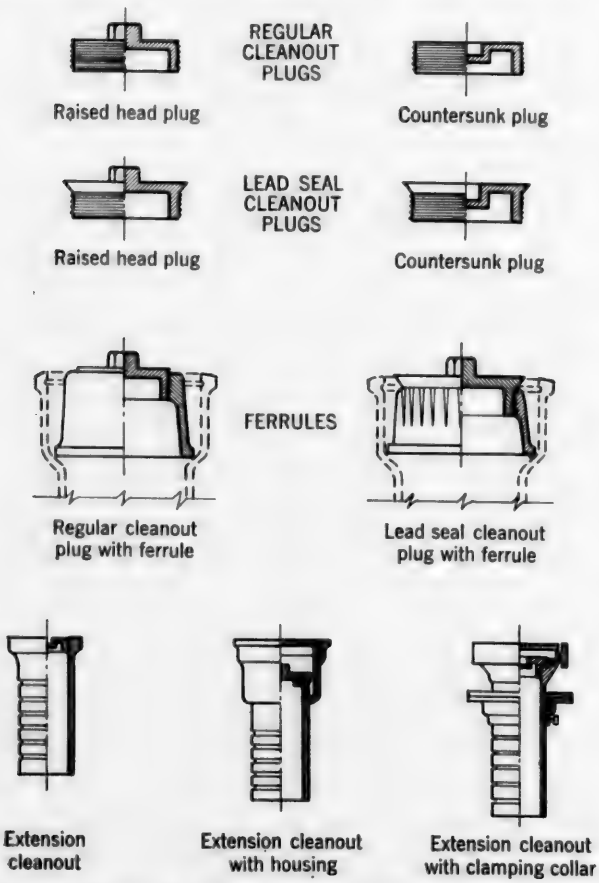


Fig. 7. Types of cleanouts that are available for various applications.

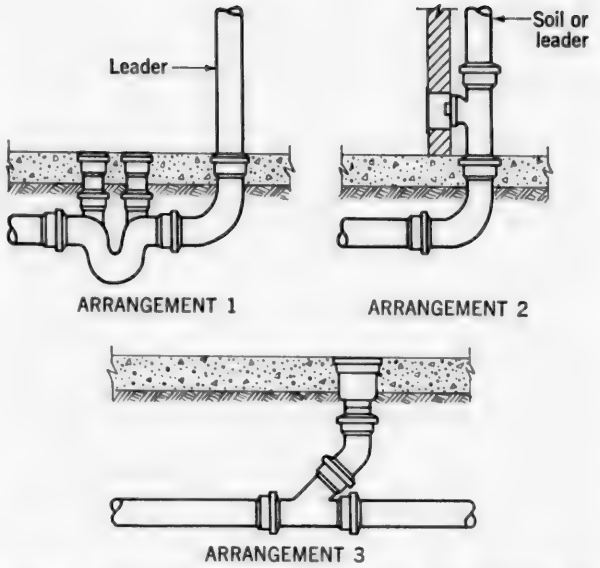


Fig. 8. Arrangements that may be used for cleanout installations.

flexibility is incorporated in the unit. Should the underground piping sag or settle slightly, the extension has freedom to move with the piping. This feature removes the danger of loose hub connections at the piping.

Where waterproofing is involved, the cleanout assembly can be furnished with a clamping collar to anchor to the waterproofing material and thus prevent seepage around the extension. The clamping collar is a loose arrangement and can be placed at any elevation on the extension shank. Once it is located, it can be secured to the extension shank by means of the set screws and the collar caulked as shown by the cross section through the unit.

The cleanout extensions are equipped with cut-off rings to permit the ease in cutting the extension to the prescribed length.

Other Cleanouts

Other types of cleanouts are required in the drainage system, and three are shown in Fig. 8.

Arrangement 1 shows the application of a running trap that is often utilized at the base of a leader stack. This trap intercepts sticks, stones or other large foreign objects that are dropped into roof drains by children or through other means. Foreign objects will lodge in the trap where they are easily removed. This arrangement uses a running trap with extensions to the floor level.

Arrangement 2 shows a cleanout that is placed at the base of the stack, either a soil or leader stack. It is placed in a vertical position above the floor. An access door provides entry to the cleanout. This type of cleanout also permits a wire snake or other apparatus to be inserted into the drainage line underground for clearing stoppages.

Arrangement 3 illustrates the extension cleanout and housing, as indicated in Fig. 7, and it can be applied to installations where there is a possibility of the underground line settling or sagging. The extension will move with the piping and will not impose any strain on the housing.

APPLICATIONS AND INSTALLATIONS

Nurses' Dormitory Solves its Special Problems With Electric Heating Wall Panels

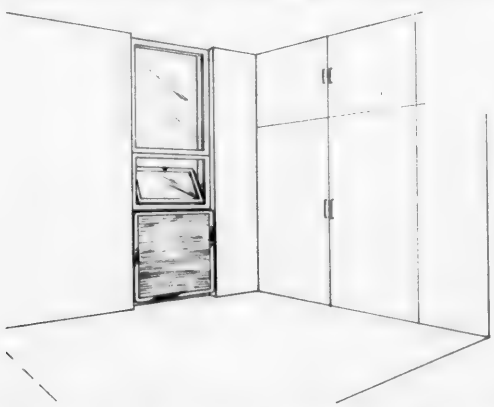
A primary reason for the consideration of electric heat in a nurses' dormitory under construction in Peoria, Ill., was the specification of round-the-clock individual heat control in each room so that student nurses rotating on 24-hour duty can have heat any time they want it. This, plus an estimated saving of $37,000 in installation costs

and $97 per year in fuel costs, compared with an oil-burning system, prompted the selection by S. Alan Baird, Peoria, consulting engineer on the job, and Foley/Hackler/Thompson/Lee, Peoria, architects for the dormitory, of an electric heating system.

The 4-story dormitory, shown in artist's sketch above, is being added to the Methodist Hospital of Central Illinois. It will use electric heating wall panels made by Sun-Tron Corp., Chicago, in the individual rooms and service areas, and a heat pump for the first floor reception and lounge area.

Dormitory exterior will have a granite slab curtain wall. Each slab will be 8½ ft square and 4 inches thick. Aluminum windows will be set between the slabs. Under the windows and within the window recess will be the 31 by 30 inch heating panels. Wattages will vary from 1000 to 1250 to 1500 for these panels since room sizes differ and also because there is greater heat loss on the top floor.

The accompanying diagram of a typical dormitory room shows an electric heating panel mounted in the



lower section of the window recess so that the unit is flush with the wall. Conduit is fed from the window jamb into the insulated pan behind the unit, and then into the unit itself. Heating panels, which provide 50% convection heat and 50% radiant heat, have an oak wood grained, plastic laminate finish to blend with room furnishings.

Primary electric service is being brought from the existing hospital building to new transformers in the dormitory. This, in effect, will give the dormitory an electrical rate of 1.05 cents per kilowatt hour, even though the Peoria utility has no special rate for electric heating. Rates are reduced by the utility from 2 cents to 1.75 cents, then to 1.3 cents and to 1.05 cents as each successive block of kilowatt hours is used up. Since the hospital is already using up the first three blocks of kilowatt hours, the additional electricity to be used by the dormitory will be charged at the 1.05-cent rate.

In addition, each of the heating panels will be equipped so that a key switch under the room thermostat can be used to disconnect a portion of the heating elements in spring and fall to save on operating costs, and to reduce overall demand charges.

Two Separate Air Conditioning Systems Aid Isolation of Library Sections

Architects and air conditioning engineers faced a unique problem when designing and planning for the new Gaylord Music Library at Washington University, St. Louis, Mo.

With the library portion of the building located directly over the listening rooms, they had to take special precaution in their plans to assure soundproof rooms. Two separate air conditioning systems are planned to prevent sound from transferring from the lower to upper levels.

Architects are Eric Smith and Robert Entzeroth of St. Louis; planning the air conditioning system is the Albert Rich Co., with Roy Ash in charge.

To insure soundproofing, architects planned a "building within a building," or the isolation of listening rooms with air space, such as corridors, separating them from the remainder of the ground floor. A seminar room, offices, lavatories and mechanics' room will be a part of that level of the building. An air space also will be left between the ceiling of the first level and the floor of the second level.

One air conditioning system in the new building will handle the entire library, stacks and offices on the second floor. This will be an all-air system, which will provide variable temperature control for the different zones on the floor.

The second system in the structure will be relegated to the music rooms on the ground floor. This, too, will be an all-air system with a separate temperature control in the area. An important feature in this system is that of noise control; silencers will be incorporated as a means of controlling the transmission of sounds through ducts between rooms.

DEGREE-DAYS FOR DECEMBER, 1959

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city

AIR CONDITIONING, HEATING AND VENTILATING's 32nd Year of Publication of Monthly Degree-Day Data

City	December			Season to Dec. 31, incl., from Sept. 1		
	1959	1958	Normal	1959	1958	Normal
Abilene, Texas (A)	520	690	595	1164	1148	1098
Albany, New York (A)	1080	1415	1197	2435	2801	2559
Albuquerque, New Mexico (A)	827	722	899	1725	1568	1757
Alpena, Michigan (C)	1146	1447	1218	3067	2903	2827
Anchorage, Alaska (A)	1450	1531	1587	4203	4534	4277
Asheville, North Carolina (C)	747	860	769	1553	1642	1633
Atlanta, Georgia (A)	575	681	614	1100	1066	1125
Atlantic City, New Jersey (C)	748	1132*	831	1553	2005*	1597
Augusta, Georgia (A)	527	667	494	946	1041	835
Baltimore, Maryland (C)	704	988	812	1462	1701	1537
Billings, Montana (A)	950	1116	1172	2767	2530	2739
Binghamton, New York (C)	929	1367	1113	2052	2696	2417
Birmingham, Alabama (A)	525	711	596	1052	1137	1128
Bismarck, North Dakota (A)	1197	1621	1535	3475	3407	3458
Block Island, Rhode Island (A)	825	1070	927	1765	2060	1936
Boise, Idaho (A)	1142	870	1054	2723	2047	2340
Boston, Massachusetts (A)	885	1190	998	1894	2207	2008
Buffalo, New York (A)	1004	1318	1116	2287	2525	2424
Burlington, Iowa (A)	932	1289	1150	2406	2323	2334
Burlington, Vermont (A)	1200	1603	1308	2791	3147	2859
Cairo, Illinois (C)	684	941	784	1542	1543	1465
Charleston, South Caroline (C)	424	502	410	687	682	658
Charlotte, North Carolina (A)	633	783	682	1205	1294	1274
Chattanooga, Tennessee (A)	651	819	710	1337	1404	1380
Cheyenne, Wyoming (A)	978	1052	1125	2900	2571	2840
Chicago, Illinois (A)	898	1315	1147	2305	2296	2352
Cincinnati, Ohio (C)	748	1064	880	1674	1774	1711
Cleveland, Ohio (A)	894	1288	1057	2089	2298	2171
Columbia, Missouri (A)	826	1065	989	2014	1853	1967
Columbia, South Carolina (A)	550	702	524	999	1102	908
Columbus, Ohio (C)	841	1255	983	1945	2209	1995
Concord, New Hampshire (A)	1100	1459	1271	2547	2996	2839
Concordia, Kansas (C)	842	1067	1029	2142	1938	2048
Dallas, Texas (A)	423	634	518	956	937	870
Denver, Colorado (A)	876	898	1032	2400	2070	2348
Des Moines, Iowa (A)	957	1294	1203	2593	2369	2455
Detroit, Michigan (A)	933	1313	1101	2278	2391	2325
Devils Lake, North Dakota (C)	1319	1761	1668	3936	3766	3795
Dodge City, Kansas (A)	849	1003	980	2057	1914	1951
Dubuque, Iowa (A)	1043	1490	1290	2891	2774	2765
Duluth, Minnesota (A)	1279	1808**	1550**	3758	3760**	3533**
Elkins, West Virginia (A)	(a)	1209	995	(a)	2460	2255
El Paso, Texas (A)	573	549	626	1045	928	1086
Ely, Nevada (A)	1205	958	1181	3036	2621	2864
Escanaba, Michigan (C)	1102	1519	1321	3049	3068	3056
Evansville, Indiana (A)	780	1103	871	1815	1927	1715
Fairbanks, Alaska (A)	2316	2238	2297	5966	6363	5929
Fargo, North Dakota (A)	1205	1684	1615	3506	3406	3538
Fort Smith, Arkansas (A)	608	826	698	1336	1341	1273
Fort Wayne, Indiana (A)	925	1366	1122	2321	2506	2365
Fort Worth, Texas (A)	450	659	533	988	988	890
Fresno, California (A)	571	470	580	923	806	1011
Galveston, Texas (C)	248	339	271	511	476	402
Grand Junction, Colorado (A)	1007	899	1132	2332	1965	2293
Grand Rapids, Michigan (A)	987	1373	1169	2525	2620	2597
Green Bay, Wisconsin (A)	1128	1543	1392	3130	3030	3035
Greensboro, North Carolina (A)	726	912	772	1508	1610	1513
Greenville, South Carolina (A)	632	734	648	1237	1186	1200
Harrisburg, Pennsylvania (A)	895	1177	964	1917	2171	1971
Hartford, Connecticut (A)	1013	1285	1082	2183	2543	2266
Havre, Montana (C)	1025	1312	1383	3148	3067	3240
Helena, Montana (A)	1112	1253	1311	3334	3095	3247
Houston, Texas (C)	266	363	303	569	548	465
Huron, South Dakota (A)	1096	1500	1407	3143	2938	3003
Indianapolis, Indiana (A)	895	1257	1051	2198	2292	2141
Jackson, Mississippi (A)	498	632	503	979	991	882
Juneau, Alaska (A)	926	1076	1159	3002	3261	3312
Kansas City, Missouri (A)	756	1016	970	1865	1672	1875
Knoxville, Tennessee (A)	687	846	744	1391	1432	1454
La Crosse, Wisconsin (A)	1057	1515	1380	2939	2800	2900
Lander, Wyoming (A)	1206	1192	1383	3270	2862	3309
Lewiston, Maine (O)	1088	1435	1295	2559	3023	2837

a) Data not available.
* Figures based on Airport readings.
** Figures based on City office readings.

Normal figures in this table are based on 30-year period covering 1921 to 1950, inclusive, as compiled and published by the U. S. Weather Bureau.

Figures in this table, with two exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Co., Utica, N. Y., and Norman E. Ross, Bursar, Bates College, Lewiston, Me., respectively.

Degree-Days for December, 1959 (Concluded)

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city

AIR CONDITIONING, HEATING AND VENTILATING's 32nd Year of Publication of Monthly Degree-Day Data

City	December			Season to Dec. 31, incl., from Sept. 1		
	1959	1958	Normal	1959	1958	Normal
Lincoln, Nebraska (C)	895	1106	1113	2326	2041	2243
Little Rock, Arkansas (A)	562	755	654	1211	1194	1179
Los Angeles, California (C)	145	132	253	170	214	451
Louisville, Kentucky (A)	771	1040	871	1665	1784	1733
Lynchburg, Virginia (A)	722	964	809	1586	1708	1625
Macon, Georgia (A)	485	587	481	881	841	824
Madison, Wisconsin (A)	1046	1499	1287	2878	2821	2707
Marquette, Michigan (C)	1093	1467	1299	3128	2995	3011
Memphis, Tennessee (A)	602	795	673	1260	1289	1248
Meridian, Mississippi (A)	522	638	528	1005	994	956
Milwaukee, Wisconsin (A)	999	1429	1218	2704	2678	2611
Minneapolis, Minnesota (A)	1073	1519	1414	3040	2868	2990
Moline, Illinois (A)	931	1319	1181	2495	2386	2426
Montgomery, Alabama (A)	480	571	491	873	843	864
Nashville, Tennessee (A)	674	886	725	1431	1509	1372
New Haven, Connecticut (A)	929	1179	1026	1951	2279	2145
New Orleans, Louisiana (C)	274	353	283	522	477	429
New York, New York (C)	805	1073	908	1684	1900	1771
Newark, New Jersey (A)	832	1103	961	1682	1983	1912
Norfolk, Virginia (A)	621	855	688	1188	1276	1257
North Platte, Nebraska (A)	1000	1193	1172	2826	2559	2563
Oak Ridge, Tennessee (C)	727	875	812	1407	1539	1587
Oakland, California (A)	448	346	508	807	712	1077
Oklahoma City, Oklahoma (A)	644	876	747	1514	1461	1367
Omaha, Nebraska (A)	923	1184	1166	2419	2186	2368
Parkersburg, West Virginia (C)	820	1127	896	1815	2028	1824
Peoria, Illinois (A)	930	1296	1128	2371	2294	2312
Philadelphia, Pennsylvania (C)	760	1046	856	1546	1851	1624
Phoenix, Arizona (A)	342	271	360	487	399	555
Pittsburgh, Pennsylvania (C)	807	1179	924	1809	2095	1890
Pittsfield, Massachusetts (A)	1139	1425	1246	2633	3015	2845
Pocatello, Idaho (A)	(a)	937	1184	(a)	2399	2727
Portland, Maine (A)	1090	1452	1237	2579	3030	2776
Portland, Oregon (C)	680	565	701	1582	1339	1600
Providence, Rhode Island (A)	942	1225	1035	2041	2344	2195
Pueblo, Colorado (A)	917	908	1051	2313	1988	2279
Raleigh, North Carolina (A)	667	865	651	1352	1460	1166
Rapid City, South Dakota (A)	949	1168	1218	2946	2533	2802
Reading, Pennsylvania (C)	856	1132	936	1782	2070	1866
Red Bluff, California (A)	522	352	564	799	678	942
Reno, Nevada (A)	1096	839	986	2481	2153	2338
Richmond, Virginia (A)	718	973	791	1501	1618	1532
Rochester, New York (A)	1052	1344	1141	2391	2612	2473
Roswell, New Mexico (A)	692	753	750	1490	1479	1415
Sacramento, California (C)	559	377	567	928	656	980
St. Joseph, Missouri (A)	858	1123	927	2175	1987	1809
St. Louis, Missouri (C)	760	1057	893	1755	1692	1703
Salt Lake City, Utah (A)	1142	887	1039	2548	2081	2279
San Antonio, Texas (A)	336	450	374	737	697	600
San Diego, California (A)	150	108	255	184	202	478
Sandusky, Ohio (C)	893	1323	1039	2108	2303	2116
San Francisco, California (C)	307	224	406	599	580	881
Sault Ste. Marie, Michigan (A)	1236	1661	1398	3313	3417	3340
Savannah, Georgia (A)	463	517	412	754	745	675
Scranton, Pennsylvania (A)	1012	1316	1057	2288	2647	2254
Seattle, Washington (C)	660	541	679	1696	1484	1682
Sheridan, Wyoming (A)	1101	1212	1271	3187	2843	3045
Shreveport, Louisiana (A)	442	621	490	965	967	848
Sioux City, Iowa (A)	1000	1333	1290	2742	2512	2708
Spokane, Washington (A)	1113	1004	1113	3002	2550	2705
Springfield, Illinois (A)	865	1187	1017	2121	2124	1998
Springfield, Missouri (A)	773	994	908	1879	1773	1833
Syracuse, New York (A)	1045	1408	1113	2339	2675	2340
Toledo, Ohio (A)	983	1354	1119	2450	2519	2364
Topeka, Kansas (C)	830	1078	977	2106	1924	1891
Trenton, New Jersey (C)	837	1105	930	1737	2028	1852
Tulsa, Oklahoma (A)	619	853	750	1417	1362	1382
Utica, New York (O)	991	1457	1144	2164	2766	2537
Valentine, Nebraska (A)	1017	1273	1212	3051	2706	2709
Walla Walla, Washington (C)	915	813	890	2132	1834	1966
Washington, D. C. (A)	704	987**	831**	1495	1669**	1604**
Wichita, Kansas (A)	747	984	915	1836	1715	1763
Williston, North Dakota (C)	1153	1508	1528	3502	3356	3495
Winnemucca, Nevada (A)	1225	890	1085	2838	2340	2595
Yakima, Washington (A)	1011	964	1066	2553	2429	2469

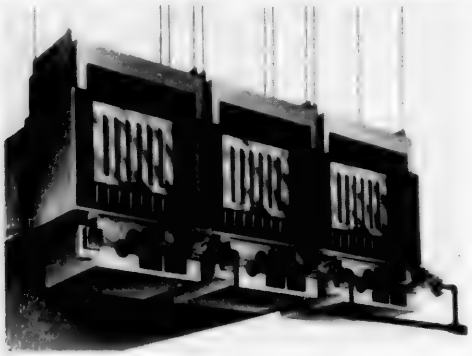
For footnotes, see page 104.

NEWS OF EQUIPMENT AND MATERIALS

Use the convenient prepaid postcard appearing on the last page for securing additional information about new equipment and materials described in this department.

Gas-Fired Duct Furnaces

A new line of gas-fired duct furnaces with special features for air conditioning applications is announced by Modine Manufacturing Co., Racine, Wis. The line incorporates removable air by-pass baffles which eliminate the need for adding by-pass ducts to handle the greater



cfm required by most systems which provide cooling; also, stainless steel burners; low-voltage controls; aluminized steel casings; built-in draft diverters; stainless steel drain pans (optional); 100% automatic gas shut-off: and self-cleaning burner ports.

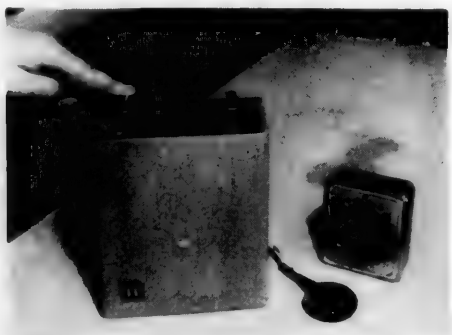
An unlimited number of duct furnaces can be mounted side-by-side in any one of three height groupings to meet any Btu requirement, no matter how great.

Available in six models from 75,000 to 300,00 Btu per hr (input), these duct furnaces are A.G.A.-approved for use with natural and mixed gases, and LPG-air mixtures.

More information? Circle Item 1, postcard, last page.

Swimming Pool Alarm System

A swimming pool alarm system—so sensitive it can detect a hand splashing in the water—is introduced by



Home Products Div., Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

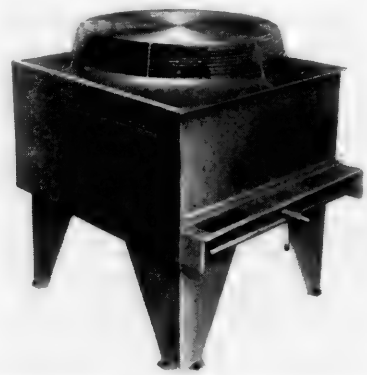
As shown in photo, system includes a sensing element (small disc in center) that is encased in a protective box (right) and mounted on the pool wall a foot below the water level. Whenever an object falls into an unattended pool, the sensing element detects the sound vibrations caused by the splash, then electronically relays a signal to the remotely located alarm panel (left). Honeywell officials said the new alarm system can be installed in new or existing pools for less than two-hundred dollars.

More information? Circle Item 2, postcard, last page.

Air-Cooled Blower Condenser

Announcement of a new type air cooled blower condenser was made by Dunham-Bush, Inc., West Hartford, Conn. Called LSBC (Low Silhouette Blower Condenser), unit was designed for use in rooftop locations.

Air movement up and out keeps noise at a minimum,



the company states. The shape allows for location on most roofs with a safe pounds-per-square-foot loading, eliminating costly reinforcing of roof members necessary to support other type units.

This unit can be located anywhere without regard to prevailing wind. Models from 5 to 53.5 tons.

More information? Circle Item 3, postcard, last page.

Better Fabric Improves Filters

An improved electrostatic polyester plastic fabric has been engineered and is now being produced exclusively for Stoddard Industries, Cudahy, Wis.

Independent laboratory tests are said to have shown that with this material, called Poly-Mag 80, the company's Dust-magnet furnaces and air conditioner filters assure improved dust pick-up. They are unaffected by humidity or by temperatures up to 230 deg F.

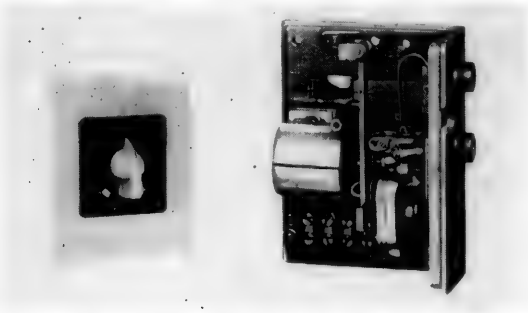
The new plastic has a higher resistance to shrinkage than previously used plastics, and has a lower pressure drop. As with the older filters in this company's line, the new filters are guaranteed for the lifetime of the unit in which they are used. Filters are manufactured for residential, commercial and industrial use.

More information? Circle Item 4, postcard, last page.

Load Limiting Relay

A new limiting device, engineered to provide positive protection against motor overload and featuring an adjustable demand limiter, is announced by Johnson Service Co., Milwaukee, Wis.

Called the R-27 load limiting relay the device which is designed for use with pneumatic control systems is applicable to all types of centrifugal refrigeration compressors. Installed in the pneumatic control circuit and



responding to motor current it limits the opening of the capacity regulating inlet valves or dampers to maintain a predetermined maximum motor current regardless of the demands of other controllers. According to the manufacturer, the relay is especially valuable in preventing damage during the "start-up" period and following prolonged or over-night shutdowns, the most common instances of overloading.

Highlights of the relay is a remotely located manual adjuster for limiting the motor current to any selected value between 40% and 100% of the maximum. It thus becomes a convenient "demand limiter," useful in reducing electric demand charges during periods of less than maximum load.

More information? Circle Item 5, postcard, last page.

Wall-Hung Water Cooler

Addition of On-the-Wall to its line of Oasis water coolers is announced by The Ebco Mfg. Co., Columbus, Ohio. The compact unit, mounted directly to the wall, can be set at any distance from the floor.

External finish is brown Scandia pattern plastic vinyl laminate on 20-gage steel. Removable front panel and grille, mirror polished stainless steel top with anti-splash ridge, wall protector back extending 3½ inches above bottom of basin; Dial-A-Drink bubbler; and provision for glass filler are all included.

Available in both 7- and 13-gal capacities, unit is also available in 18-8 gage stainless steel cabinets.

Mounting bracket and template are provided. Accessories include: glass fillers, special masonry type wall hanger and special bracket for framed construction.

More information? Circle Item 6, postcard, last page.

Adds Three Fiberglass Duct Fans

Expansion of its line of fiberglass duct fans to include sizes from 12 to 36 inches is announced by Hartzell Propeller Fan Co., Piqua, Ohio. These fans, which under many conditions offer resistance to corrosion equal to or exceeding that of stainless steel or monel construction at substantially lower cost, are now available in 12, 16, 20, 24, 28 and 36-inch diameters.

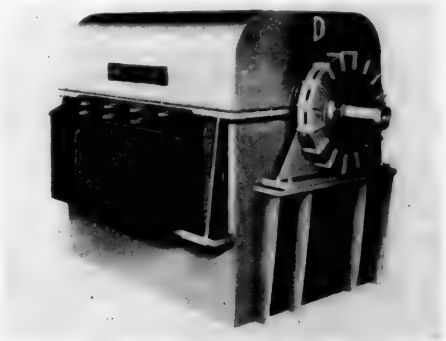
The propeller, duct section, drive housing and bearing cover on these fans are made of fiberglass; drive shaft and hardware are stainless steel.

More information? Circle Item 7, postcard, last page.

Fluid Drives for Feed Pumps

A new line of adjustable speed Gyrol fluid drives, developed specifically for use with "on-the-shaft" boiler feed pump drive arrangements, is available from American-Standard Industrial Div., Detroit, Mich. "On-the-shaft" refers to the arrangement whereby the boiler feed pump is driven directly from the main turbine generator shaft.

Designated Type VS Class 7, the units are designed specifically for the heavy duty required of boiler feed



pump drives. They provide a stepless, infinitely adjustable speed control. The adjustable speed feature saves power over the entire operating range. Units are available for use with any size boiler feed pump. Standard units are available for either 3600 rpm or 1800 rpm operating input speed.

Fluid drive shaft height is matched to the centerline height of the main turbine shaft for the simplest possible floor mounting. The Class 7 unit is arranged for below-floor installation of auxiliary cooling equipment and related piping. This arrangement keeps the turbine floor free of auxiliary equipment.

More information? Circle Item 8, postcard, last page.

Partition Piece Saves Time

Apartment House Div., Slant/Fin Radiator Corp., Richmond Hill, N.Y., has introduced a partition piece which permits the installation of full perimeter baseboard systems immediately after the rough flooring is put in, and before the partitions are put up or even marked.

This has resulted in a savings of over 20% of the time normally allocated for this operation. Previously the installation had to be done after the partitions were completed. This time saving is largely accounted for by the

uncluttered and undivided space the steam fitter has to work in, and the elimination of having to weave in and out of rooms in order to complete the installation. The partition piece not only allows the steam fitter to work in a large unencumbered space, but he does so without interference or delays caused by other trades.

The partition piece is equipped with an angle iron lath support and sturdy braces to maintain ⅛-inch clearance and to permit full operation of the damper. The lath support allows for the finish plaster to be brought flush to the partition piece, and makes for an excellent finished job, the company reports. The sound deadener, of die-cut fibreglass, fits over the pipe and fills in the full space between the pipe and the enclosure. In addition to its function as a sound deadener, this fibreglass material acts as a fire stop between rooms.

Photo shows a closeup of the partition piece, showing the spines and their placement. They are set for normal partition thickness as demonstrated in the photo, but can be ordered to meet specific situations. While the partition piece and sound deadener are particularly suitable for apartment house construction, office buildings and commercial buildings can also benefit from the technique.

More information? Circle Item 9, postcard, last page.

Halogen Leak Detector

For locating refrigerant leaks when the atmosphere may be heavily contaminated with halogen gas, a portable electronic leak detector equipped with a special probe is available from General Electric Co., Schenectady, N. Y.

The company's Instrument Department says the leak detector kit will be useful in locations where concentrations of halogen compounds such as refrigerants, paints, and varnishes may be present in the air. Typical uses would be during the installation of large commercial and shipboard air conditioning systems, and in checking for refrigeration leaks in confined, unventilated devices such as vending machines.

The kit consists of a low-cost Type H-6 leak detector equipped with a newly designed proportioning probe, and a Type LS-20 leak standard. The equipment is packaged in a compact leather case for portability and for protection.

The probe works this way: by twisting an adjustment at its tip, the operator can mix varying amounts of pure air—cleaned by a built-in filter—with the air being drawn through the probe. This "dilutes" the air being tested so that halogens present in the atmosphere will not be detected. The leak detector, however, remains fully sensitive to all refrigerant leaks of ½ ounce a year and larger.

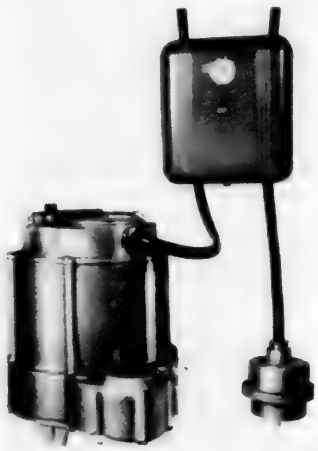
Leak detectors equipped with the new probe operate accurately in areas where air contamination is ten to twenty times above the normal limit for standard models, the company states.

The leak standard included with each kit is necessary for calibrating and checking detector sensitivity, and for use in determining the size of leaks.

More information? Circle Item 10, postcard, last page.

Industrial Sump Pump

To meet the sump pump needs of industrial users with 3-phase equipment, Kenco Pump Div., American Crucible Products Co., Lorain, Ohio, announces its Model 330 heavy-duty, ½-hp, 3-phase, 60-cycle industrial sump pump for 230-volt operation with 3-amp maximum operating current.



Completely submersible, lifetime lubricated, this model is made of bronze, has a bronze impeller, and a direct-drive, non-clog completely sealed oil-filled motor chamber that eliminates condensation, keeps bearings constantly bathed in oil, and removes heat to keep the motor cool.

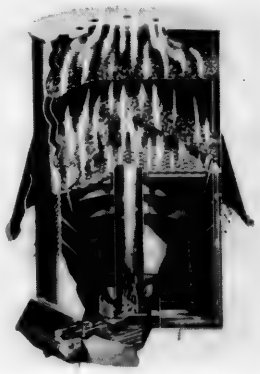
Pumping capacity is 5000 gph at a 10-ft discharge head. Included are pump, external liquid level control, and motor starter. Unit needs no adjustment, has no floats, weights or wires to foul up or corrode. A non-automatic model is furnished as a pump only without starter and overload heaters.

Pump is built for heavy-duty sump operation in utility tunnels, elevator pits, transformer vaults, loading docks, wash tanks, and for removal of factory wastes.

More information? Circle Item 11, postcard, last page.

Oil Bath Air Cleaner

An oil bath air filter with a pneumatic oil lift and no moving parts is introduced by American Air Filter Co., Louisville, Ky. The redesigned Model "C" P01 Cycoil brings the industry, in one unit, the advantages of an automatic self-cleaning air cleaner with extremely high efficiency and low maintenance requirements, the company reports. At the same time, the cost of installation and maintenance has been materially reduced and simplified.



The major improvement in the model is the pneumatic lift, a simplified method of lifting oil from the reservoir to the perforated oil distribution plate, which, in turn, distributes the oil to the pads. This replaces the motor-driven oil circulator used in previous models, and elminates the need for provision for electrical power with its complications of voltage rating, phase designation, and special protection for hazardous locations. Equally important is the elimination of the added maintenance of motor lubrication, brush replacements and circulator wear.

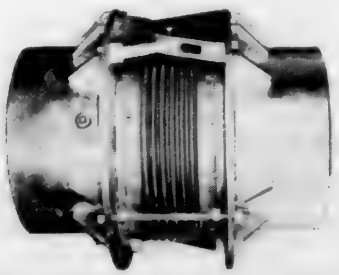
Units are installed as air cleaners on engine intake on gas and oil transmission lines, at refineries, natural gasoline plants, and municipal power plants.

More information? Circle Item 12, postcard, last page.

Hinged Expansion Joints

Zallea Brothers, Wilmington, Del., announces a hinged-type expansion joint for piping systems that, because of their size or location, cannot be supported or anchored by conventional means.

These hinged expansion joints permit a piping system to be entirely self-supporting. This eliminates the need for additional supports and reduces pipe line bending



stresses. Movement is more closely controlled than with any other type of expansion joint.

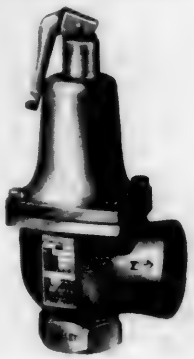
Shear loads can be carried by the joints, which can also absorb piping weight, wind loads, and other dead loads without extensive anchoring. Bellows torsion is prevented and the resulting piping system is more stable than with other types of expansion joints, the company reports.

The standard model of hinged expansion joint is designed to take rotation in one plane only. For this reason, these expansion joints are used in combinations of two or three. Slotted hinges are available for special applications where axial movement must be permitted, but these units do not absorb axial pressure thrust.

More information? Circle Item 13, postcard, last page.

ASME-Rated Relief Valves

Watts Regulator Co., Lawrence, Mass., announces a new, full line of ASME-rated pressure safety relief valves for hot water space heating boilers. Available in ¾ to 2-inch sizes, No. 740 Series valves have large internal flow areas and expanded outlets.



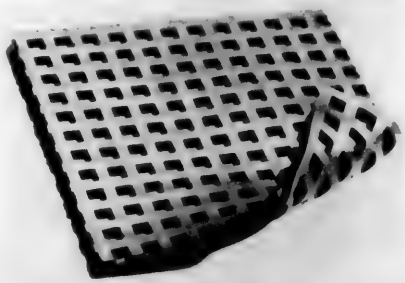
Extremely high discharge capacities make them economically suited for boilers which previously required larger size valves for sufficient protection, according to the manufacturer, thus providing not only a much lower cost but also simplified stocking.

More information? Circle Item 14, postcard, last page.

Machine Mounting Pad

Low-cost machine mountings are said to be possible by the use of Fabcel Pads, product of Fabreeka Products Co., Inc., Boston, Mass. They eliminate the need for bolts, lag screws or cement under most machines, it is said.

The pad's suction cells anchor machine to floor and



at the same time control vibration, absorb shock, reduce noise and improve machine performance.

For best results, pads should carry a load of approximately 50 lb per sq in. except under impact machinery such as punch presses, where the loading should be reduced to approximately 25 lb per sq in.

Manufactured in 18-inch squares, pads are easily cut to any shape desired.

More information? Circle Item 15, postcard, last page.

Cabinets Hide Electric Baseboard

Chromalox Draft Barrier metal storage cabinets give abundant storage space and, with Chromalox electric baseboard mounted behind, provide concealed perimeter heating, states the manufacturer, Edwin L. Wiegand Co., Pittsburgh, Pa.

Cabinets and baseboard may be used as an independent room heater or with unit ventilators to eliminate discomfort from downdrafts on long cold windows. If desired, baseboard may be installed first and the cabinets added

later when needed. Cabinet base and top grille are perforated to allow air circulation to the baseboard heaters. Cool air enters through the cabinet base, is heated and rises upward through the top grille—counteracting downdrafts. The rugged, 16-gage steel cabinets with adjustable shelves are factory finished in baked-on coral-tan enamel.

Cabinets are available in 2, 3 and 4-ft lengths, 26½ inches high, 13¼ inches deep and may be joined together to form longer lengths for full wall coverage. Removable end panels are available to complete the trim appearance of the cabinets. Sliding doors are available in matching colors and are quickly installed at any time. They are well suited to school, office and library.

More information? Circle Item 16, postcard, last page.

Seals, Lubricates Threaded Joints

A chemically-inert plastic tape designed to seal and to permanently lubricate threaded and coupled pipe joints is announced by Irvington Div., Minnesota Mining and

Manufacturing Co., St. Paul, Minn. Called Scotchrap brand Dry Thread Sealer No. 4212, this unfused film tape can be applied in seconds and conforms to all types of pipe threads and fittings in any pipe system, low pressure or high.

Applications for this tape include gas meter hook-up, oil casings, oil rigs and refineries, chemical plants, conduit, couplings, valve sealing, high pressure systems and chemical lines.

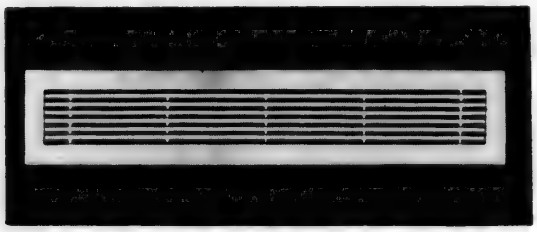
This white, pliable ½-inch wide tape is available in 260-inch or 520-inch lengths on handy pocket-size rolls.

More information? Circle Item 17, postcard, last page.

Extruded Aluminum Grille

The Curtainaire, an extruded aluminum grille for supply or return installations, is added to its broad line of air distribution products by Carnes Corp., Verona, Wis.

Grille is available in widths from 1½ to 15 inches and



in lengths up to 12 ft in one piece. The bars are obtainable in 0° or 15° settings and are spaced so as to be pencil-proof.

Two frame widths are standard, with friction springs for floor or sill installation, or safety catches for wall or ceiling installations. Accessories for this grille are opposed blade damper, straightening vanes and blanking baffles.

More information? Circle Item 18, postcard, last page.

Closed-Circuit Water Cooler

An evaporative water cooler said to make it possible to control condensing pressure to within a very narrow range is offered by Recold Corp., Los Angeles, Calif. Called Dri-Fan, it can be used with single or multiple compressor systems with all of the advantages of water-cooled condensers but eliminating scaling problems.

Purified water is circulated through a closed system completely eliminating scale or other deposits in the condensers. Water returning to the evaporative cooler is at temperatures well below those at which hard scale will form on the tube bundle of the cooler.

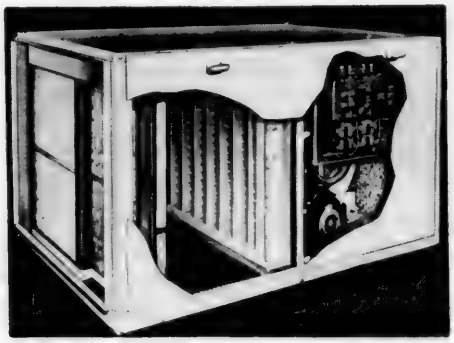
Condensing temperatures are held to within a few degrees of designed conditions, thus assuring full compressor capacity during summer weather without overloading the motor and, also, assuring proper head pressures during winter conditions. The constant condensing conditions have resulted in great savings in system maintenance cost, the company states.

Complete catalog information, including selection tables showing capacities in the range of all normal operating conditions, and a simple method of accurately selecting evaporative water coolers for multiple compressor applications are offered.

More information? Circle Item 19, postcard, last page.

Residential Electric Furnace

Addition of an electric furnace, Type 319, by Mueller Climatrol, Division of Worthington Corp., Milwaukee, Wis., to its furnace line is designed to give the homeowner the means for a complete year-round climate control system regardless of fuel.



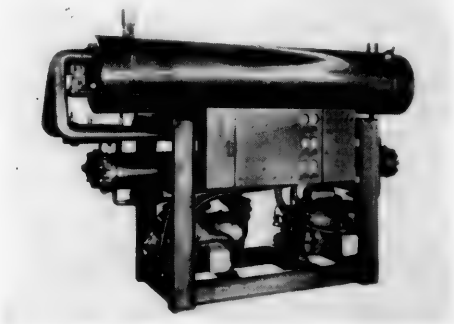
Furnace is available in 81,840 Btu per hr output. It is easily adapted to central air conditioning by placing a cooling coil directly into the casing, without changes in furnace or plenum arrangement. A new centrifugal type remote condenser can be used as part of this cooling system.

Horizontal design lends well to suspension in crawl space, basement, utility room, or attic. Unit operates with or without a duct system.

More information? Circle Item 20, postcard, last page.

Chillers Have Stand-by Features

Packaged water chillers, which for the first time in the industry feature twin hermetic compressors with individual motors for longer life and stand-by protection of refrigeration and air conditioning equipment, are announced by Acme Industries, Inc., Jackson, Mich.



Known as Model HHD, the new line of 40-250 tons capacity is reported to pioneer a means of equalizing wear in two-compressor systems, as well as providing the added protection of two motors, either of which will keep the system in operation in the event one motor fails. This is a departure from current industry design in which a single double-end motor drives both compressors, pumping whether one or both is operative, and offers no stand-by protection if the one motor fails, according to the company.

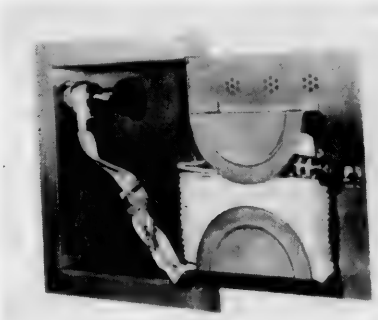
An electrical switch on the control panel permits the owner to equalize the wear on the compressors and motors. If the second compressor and motor operate only 25% as much as the first, for example, the switch can be used periodically to change the "lead" compressor and balance out the wear.

Dual refrigerant circuits and control panels further insure against complete interruption of service for the air conditioning or refrigeration system supplied by the packaged water chiller.

More information? Circle Item 21, postcard, last page.

Foul-Proof Fire Hose Cabinet

W. D. Allen Manufacturing Co., Bellwood, Ill., announces development of a new Hozegard fire hose cabinet featuring a unique half-circle door rack that prevents hose fouling. The rack is mounted on the inside of the cabinet door, permitting it to swing out a full 180° for instant hose withdrawal and aiming in any direction.



When installed with its exclusive hose clip, the Hozegard is reported to be the first fire hose cabinet to be completely Underwriters' listed. Cabinets are available with or without extinguishers in a choice of sizes and style. They can be flush-mounted in any wall or floor area, and hold up to 100 ft of 1½-inch linen hose.

More information? Circle Item 22, postcard, last page.

Coil Products Oxide Free

Drayer-Hanson Div., National-U.S. Radiator Co., Los Angeles, Cal., announced a new fabrication process said to make all coil products completely copper-oxide free.

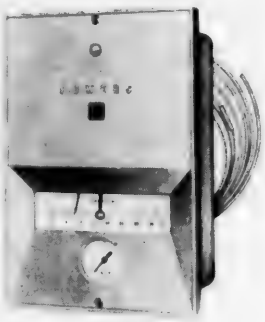
Formerly, carbon oxide formed on copper tube adjacent to the areas where heat was applied to bring silfoss to brazing temperature. The solvent action of the Freon in the operating system gradually dissolved the copper oxide which then migrated to the compressor with adverse effects on bearing life, and causing clogging of valves, strainers, and driers.

When copper is heated to the melting point of silfoss, copper oxide is rapidly formed. Now, to avoid this, the company is displacing the air inside the tubes with a reducing agent, CO_2. According to the company, the result is an interior coil surface that will remain bright and clean.

More information? Circle Item 23, postcard, last page.

New Submaster Regulator

A new submaster regulator has been developed for accurate control of remotely readjusted temperatures in heating, air conditioning and industrial processes. Called Series 200 submaster regulator, it is made by The Powers Regulator Co., Skokie, Ill.



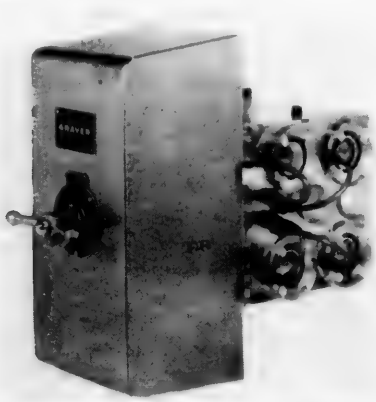
The device is a pneumatically operated temperature controller, whose control point is reset by a master controller or positioning switch. The master may be a thermostat, hygrostat, pressure regulator, or a manual positioning switch. The submaster has a throttling range adjustment of 0 to 35%. The gas-filled thermal system is unaffected by cross ambient bulb and capillary temperatures. It also eliminates the need for bulb elevation correction. It is provided with direct action and reverse adjustment. Action and adjustment can be readily converted.

Typical applications are fan discharge control, remote process control, hot water zone supply, and dewpoint control.

More information? Circle Item 24, postcard, last page.

Zeolite Softener Valve

A single control valve for directing flow of liquids in zeolite softeners, ion exchange units and filters is introduced by Graver Water Conditioning Co., New York, N.Y. Called the Monotrol, valve is designed to perform the functions of a nest of individual valves while providing greater ease in operation and maintenance. It is available in cast iron or in acrylic plastic (illustrated) for corrosive service, and can be operated manually or automatically.



Valve includes a pilot control, has positive hydraulic pressure actuation and easy maintenance. All internal moving parts can be readily removed for inspection and service without dismantling the connecting piping or removing the valve from the unit on which it is being used. In addition, the design provides for low pressure loss during operation and no contamination of effluent with influent.

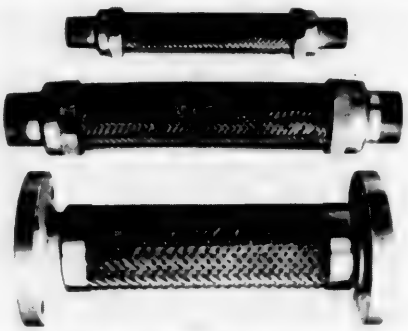
When the pilot is set, hydraulic pressure acts to move the pistons which open and close ports in the valve body, thus allowing liquid to flow through the proper channels and accomplish the required operation. The pistons direct the flow for four basic functions: service, backwash, regeneration and rinse (with the regeneration step omitted in filter applications). Upstream line pressure is all that is required to actuate the pistons.

More information? Circle Item 25, postcard, last page.

Flexible Metallic Connectors

Penflex flexible metallic connectors introduced by Pennsylvania Flexible Metallic Tubing Co., Philadelphia, Pa., have been developed for pump installations, hot water systems, and steam systems where thermal expansion and vibrations are problems.

According to the manufacturer, they have been tested



for the correction of pipe misalignment, as connectors to absorb pipe expansion in steam and hot water lines and on pumps where the vibration of the unit must be dampened so as to prevent unwanted noise and vibration being transmitted along the lines to other parts of the building.

Connectors are available in bronze and stainless steel. The bronze connectors range in size from ½ to 4 inches ID and the stainless steel from 5 to 12 inches ID. They will stand pressures from 125 to 600 psi, varying with the tube ID and the material of construction.

More information? Circle Item 26, postcard, last page.

Adds 4 Types of Plastic Pipe

One-stop purchasing of both asbestos-cement pipe and plastic pipe is now offered by Keasbey & Mattison Co., Ambler, Pa., with the introduction of its four types of plastic pipe. The move is intended to simplify pipe procurement for customers who have a need for both asbestos-cement and plastic pipe. Savings are seen for users who incorporate both kinds of pipe into a given system.

Literature is available describing "ABS" (acrylonitrile butadiene styrene), normal-impact "PVC" (polyvinyl chloride), polyethylene, and K&M high-impact styrene alloy sewer pipe.

More information? Circle Item 27, postcard, last page.

Aluminum Alloy Pipe Fittings

Its versatile line of light weight Pipe-Mate fittings and flanges has been expanded by Tube Turns Div., Chemetron Corp., Louisville, Ky., to include aluminum alloys and most other weldable metals and alloys.

The complete line of fittings is available in ½ to 4-inch pipe sizes, Schedule 10S. Illustrated are 2½ and

3-inch elbows, a 3 x 2½-inch concentric reducer and 3-inch stub end of Type 6063T6 high strength aluminum alloy.

Light weight contributes to lower shipping costs, easier handling and lower installed cost for nominal temperature, low pressure process piping, the company states. Long tangents permit easy alignment of pipe and fittings and fabrication of completely flanged elbows, returns, tees and crosses.

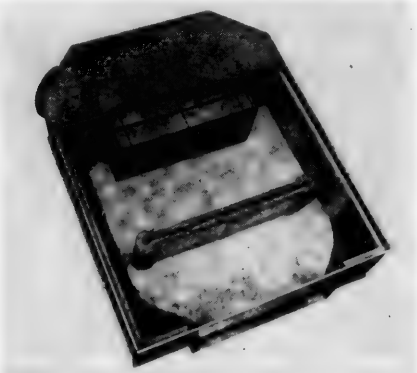
A variety of installation methods includes butt welding, fillet welding or brazing with use of aligning connector, Victaulic coupling, use of stub end and backup flange, and unique "rolled-in" flange assembly.

More information? Circle Item 28, postcard, last page.

High Velocity Valve Attenuator

Kno-Draft Series 45P, a new valve attenuator designed especially for use in dual duct, constant volume high velocity air distribution systems, is available from Connor Engineering Corp., Danbury, Conn.

Engineered features which are said to give the series

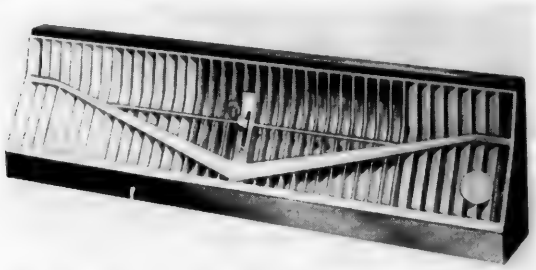


distinct application advantage over motorized valves include direct pneumatic activation of valves and controls, eliminating the need for any motors or linkage; acute sensitivity to slightest variation in control pressure, ensuring true linearity completely without hysteresis; and positive commingling of hot and cold air streams without stratification in air outlet. Additionally, the unit's operation is quiet, and it is calibrated for capacity determination.

More information? Circle Item 29, postcard, last page.

Polystyrene-Face Diffuser

The Super 38 air diffuser, announced by Air Control Products, Inc., Coopersville, Mich., is an 18-inch model with 38 square inches of free area. Its high impact polystyrene face never cracks, rusts, or mars, the company states.



Styling blends into the decor of contemporary homes. A wide air pattern blankets the wall. According to the manufacturer, it is priced for builder, contractor, or developer, without sacrifice in quality.

Face of diffuser is easily removed and replaced, permitting installation on the sub-floor and plastering into the wall, if desired.

More information? Circle Item 30, postcard, last page.

Filter Renews Manually

Designed to operate in a pressure differential range from 0.3 to 0.6 inches of water column, and from 350 to 500 fpm, a manual Roll-Kleen is developed for high-performance, low-cost installations by Farr Co., Los Angeles, Calif.

The filter unit comes in kit form for assembly at the point of installation. It carries media rolls 70 ft long in the proper widths for 3, 4 or 5 ft wide filter sections. Unit heights range from 5 to 15 ft in increments of 4 inches. Each filter section is shipped knocked down and is simple to assemble at the job site. Two or more sections can easily be bolted together and all structural members are of sturdy, heavy-gage steel.

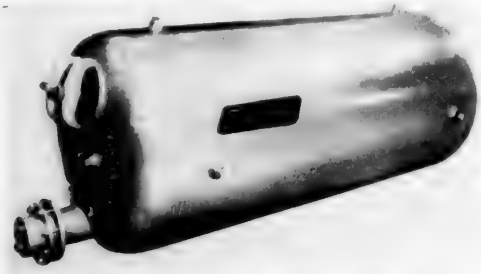
In operation, the manual wheel changes media quickly, rolling used media down across the face of the filter to the lower disposable roll. Maintenance is infrequent except under extreme conditions and is signaled by a warning light or standard draft gage.

More information? Circle Item 31, postcard, last page.

Hot Water Storage Tanks

A line of hot water storage tanks is added to the line of water heating equipment offered by Raypak Co., El Monte, Calif.

A feature of the tanks is full glass lining, which is possible because an 11x15 inch access manhole is pro-



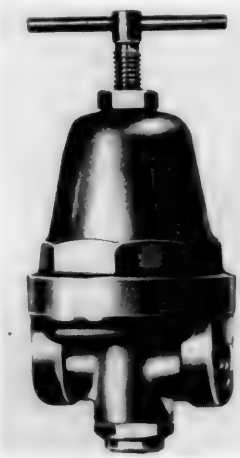
vided so the glass lining can be done after the ends are welded to the tank, thus affording complete glass lining of these seams.

The tanks are also fully protected by a magnesium anode, and the 100% steel construction meets both ASME code and military specifications, the company states. Addition of the storage tanks gives the firm a complete package in offering hot water systems, including every unit of equipment but the actual piping.

More information? Circle Item 32, postcard, last page.

Pressure Reducing Valves

Series Type A-360 and A-361 pressure reducing and regulating valves for air, oil, water, gases (except steam) and all non-corrosive fluids are offered by A. W. Cash Valve Mfg. Corp., Decatur, Illinois.



According to the manufacturer, outlet pressures are not affected by wide variations in inlet pressures or variable rates of flow. A balanced internal piston design accomplishes this regulation feature. Type A-360 units have forged brass bodies in the ¼ and ⅜-inch sizes. The ½-inch size has an all bronze body. All sizes have female inlets and outlets.

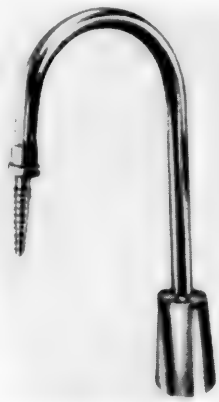
All sizes of Type A-361 are designed for three- or four-way use: having one inlet and three outlets; two inlets and two outlets. Type A-361 pressure reducing and regulating valves have all bronze bodies, and are available in ¼, ⅜ and ½-inch sizes.

All valves can be supplied with or without inbuilt bleeders. Available with *T* handle, and wing nut and bushing for panel mounting. Spring ranges from 2 to 175 psi, with maximum temperatures of 200 deg F.

More information? Circle Item 33, postcard, last page.

Stainless Lab Fixtures

Stainless steel service fixtures are avialable in the Lab-Flo line for laboratory furniture from T & S Brass and Bronze Works, Inc., Westbury, L. I., N. Y.



Illustrated is the BL-7510-3 rigid gooseneck fixture for deck mounting with clearance to tip of 5¼ inches and overall height of 12¾ inches. Other items in the line, all fabricated of Type #316 stainless steel, include turrets and panel flanges with straight serrated tips, and straight stops with wheel handles and color coded indexes.

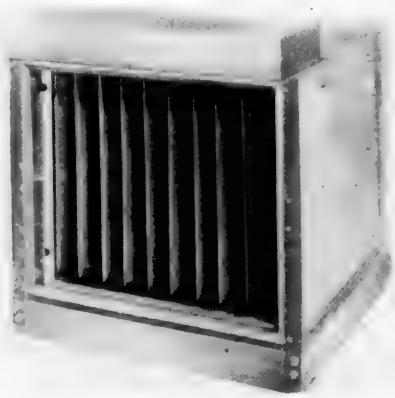
These heavy-duty fixtures, implementing the company's regular line of chrome-plated fixtures, have been developed for use in general laboratory fume hoods to resist corrosion. They are also particularly advantageous for use in radioisotope fume hoods where fixtures must be cleaned down and decontaminated periodically with strong detergents and, sometimes, with acid solutions.

More information? Circle Item 34, postcard, last page.

Electronic Air Cleaner

An addition to its line of Staynew filters, the Hi-Velocity electronic air cleaner, is marketed by Dollinger Corp., Rochester, N. Y.

Filter is said to be up to 95% efficient while eliminating smoke, airborne dust and pollen in all types of ventilating systems. Based upon the principle of electrostatic precipitation, the cleaner charges the dust particles as they enter the unit. The particles are then attracted to and held by the negatively charged collector plates.



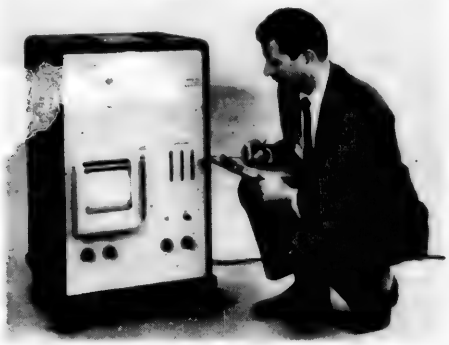
Ionizing and collecting chambers are in one, compact unit. Lightweight construction permits overhead mounting where necessary. With unit construction, all high voltage leads may be made from the front for added convenience and safety. It is available in six models either field assembled or in cabinet unit form.

More information? Circle Item 35, postcard, last page.

Atmospheric-Particle Monitor

An atmospheric-particle counting instrument, Model PC-200, available from Royco Instruments, Inc., Mountain View, Calif., is designed for the continuous monitoring of outdoor air, or atmospheres of indoor locations, such as ultra-clean work areas.

The unit presents, on a strip-chart recorder, a permanent record of aerosols present in an overall range from



0.3 microns to any desired upper limit. This record is differentiated into 15 sub-ranges and recorded in sequence at intervals which can be predetermined in length. Stability problems are eliminated by the fact that the unit is continuously self-calibrated.

Included in the instrument is an alarm system which can be set for a remote indication of particle concentrations in any of the monitored sub-ranges exceeding a predetermined maximum.

Counting rate is 1000 particles per min with a 1% coincidence loss at the standard flow rate of 100 cc per min. Recordings are made on a 6-inch strip chart at a standard movement of 8 inches per hr. Operation is from a 115-v, 60-cps supply with a current of 3 amperes.

Weight is approximately 150 lb. Unit is 21 by 19 by 32 inches overall. It is mounted on greaseless, dustless casters.

More information? Circle Item 36, postcard, last page.

Pocket-Size Pitot Tubes

In addition to its standard line of pitot tubes, F. W. Dwyer Mfg. Co., Michigan City, Ind., now offers a

series of pocket-size tubes fabricated from hypodermic-needle-grade stainless steel. With an OD of only ⅛ inch, and overall lengths of 6 or 12 inches, the tubes are small enough to fit easily into standard pocket-size gage cases.

Having a unity coefficient and with no sacrifice in accuracy, these tubes, because of their smaller diameter and correspondingly less turbulence, give excellent results in duct diameters of 4 inches or less, and will perform comparably with standard size tubes in any duct where insertion of not more than 12 inches is required. They can be used in pipes as small as ½ inch diameter.

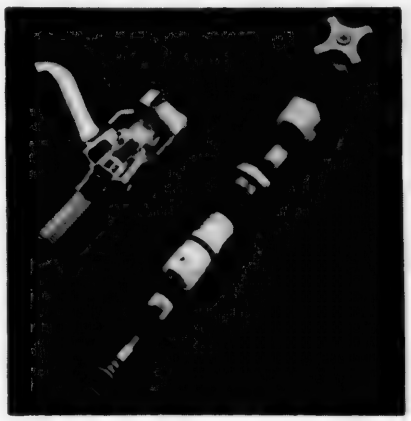
Because of the spring-like quality of the stainless steel used, the tubes may be flexed without damage, and may be used in temperatures up to 800 deg F. All joints are silver soldered and special extreme temperature types are available on special order. The hemispherical tip is almost impossible to damage and static openings are carefully machined for maximum accuracy. With a variety of mountings, tubes may be used by installers and service men as well as for permanently mounted or OEM installations.

More information? Circle Item 37, postcard, last page.

Plastic Parts Improve Valve

Significant savings and improvements in product design are advantages foreseen in one of the earliest commercial uses of Delrin acetal resin by the plumbing industry.

The plumbing innovation employs Du Pont's new thermoplastic for parts formerly made of brass in the internal cartridge mechanism of a self-seating faucet produced by Kel-Win Mfg. Co., Richmond, Va.



Delrin, a high-strength polymer with metal-like properties, is used for four parts of the cartridge mechanism as seen in cut-away illustration. According to the valve manufacturer, the injection-molded parts currently represent a 60% cost saving over the brass parts used previously. In the event of mass-volume production, it is estimated that these savings would approach 80%.

Performance improvements made possible by use of the plastic include freedom from either corrosion or deposits from hard water. Additionally, its high insulating property tends to keep faucet handles from becoming hot.

Strength, dimensional stability, stiffness, and resistance to heat distortion of Delrin are said to promise durable service. Recent field tests indicated that plastic shower heads should have a useful life of more than 20 years, Du Pont states.

More information? Circle Item 38, postcard, last page.

1960 Product Line Detailed

The Trane Co., La Crosse, Wis., has embarked on the most extensive new product program in its history, the company announced.

Absorption Chiller

Leading the list is the recently introduced Absorption Cold Generator. The completely hermetic absorption water chiller has single-shell construction and completely automatic operation. Factory assembled and wired to provide installation flexibility and lower costs, it is available in nine sizes from 100 to 350 tons.

More information? Circle Item 39, postcard, last page.

Reciprocating Compressor

A Reciprocating Cold Generator with a hermetic model of the company's compressor is also available. Units are available in 11 sizes and range from 10 to 100 tons. The 10 ton units use R-12, others use R-22. All units are available with either pneumatic or electric controls. Control panels are factory wired. Compressor-chiller units are available with remote evaporative or air cooled condensers.

More information? Circle Item 40, postcard, last page.

Hermetic Compressor

A hermetic compressor to meet the more rigorous demands of R-22 has single-housing construction which minimizes alignment problems. An internal protector avoids conditions that cause high motor temperature. It is available in capacities from 10 to 100 tons.

More information? Circle Item 41, postcard, last page.

Unit Ventilator

A unit ventilator is available with air conditioning, as well as heating and ventilating. Refrigeration may be included when the unit is installed or added later. The units can be equipped so future cooling requires only the addition of a source of chilled water. The new units are only 11⅝ inches deep providing extra, useable classroom area. Matching cabinets and shelving also are available.

More information? Circle Item 42, postcard, last page.

Heating and Cooling Coils

Complete lines of heating and cooling coils are said to be more compact and are designed to minimize air bypass in addition to minimizing moisture carry-over on dehumidifying coils. A non-freeze type coil with one-inch tubes provides optimum temperature distribution, the company states. Cast iron headers provide ruggedness and lower water pressure drop. Coil is completely drainable and cleanable.

More information? Circle Item 43, postcard, last page.

Central Station Air Conditioners

Central station air conditioners offer more sizes and more combinations for quicker, less costly solutions to a wider variety of applications. Draw through and blow through types, including multi-zone models, are available in low- and medium-pressure types in capacities from 1,200 to 47,000 cfm. Dimensions have been reduced to offer more compact units. Damper design is said to eliminate stratification, opposed-blade face dampers to provide better control. Multi-zone units provide independent, variable controls for as many as 14 zones.

More information? Circle Item 44, postcard, last page.

Industrial Fans

A new line of industrial fans in three basic wheel types, one for air fumes and gases which has backward inclined blades; another for granular material which has straight blades; and a third for stringy materials which has straight blades with outside rim omitted. Fans are available in all AMCA established standard wheel sizes from 19⅛ to 64⅜ inches.

More information? Circle Item 45, postcard, last page.

Compact Heat Pump

A compact heat pump in sizes from three to 15 tons is a water-to-air model with pre-wired controls and easily accessible water piping and connections. Fans can be rotated in the field to change air discharge direction.

More information? Circle Item 46, postcard, last page.

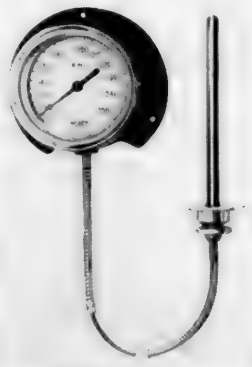
Gas-Fired Unit Heater

A gas-fired unit heater is available in propeller, blower and duct styles. A range of 25,000 to 250,000 Btu capacities is available. Exclusive louver fin diffuser pinpoints direction of heat.

More information? Circle Item 47, postcard, last page.

Vapor-Actuated Duct Thermometers

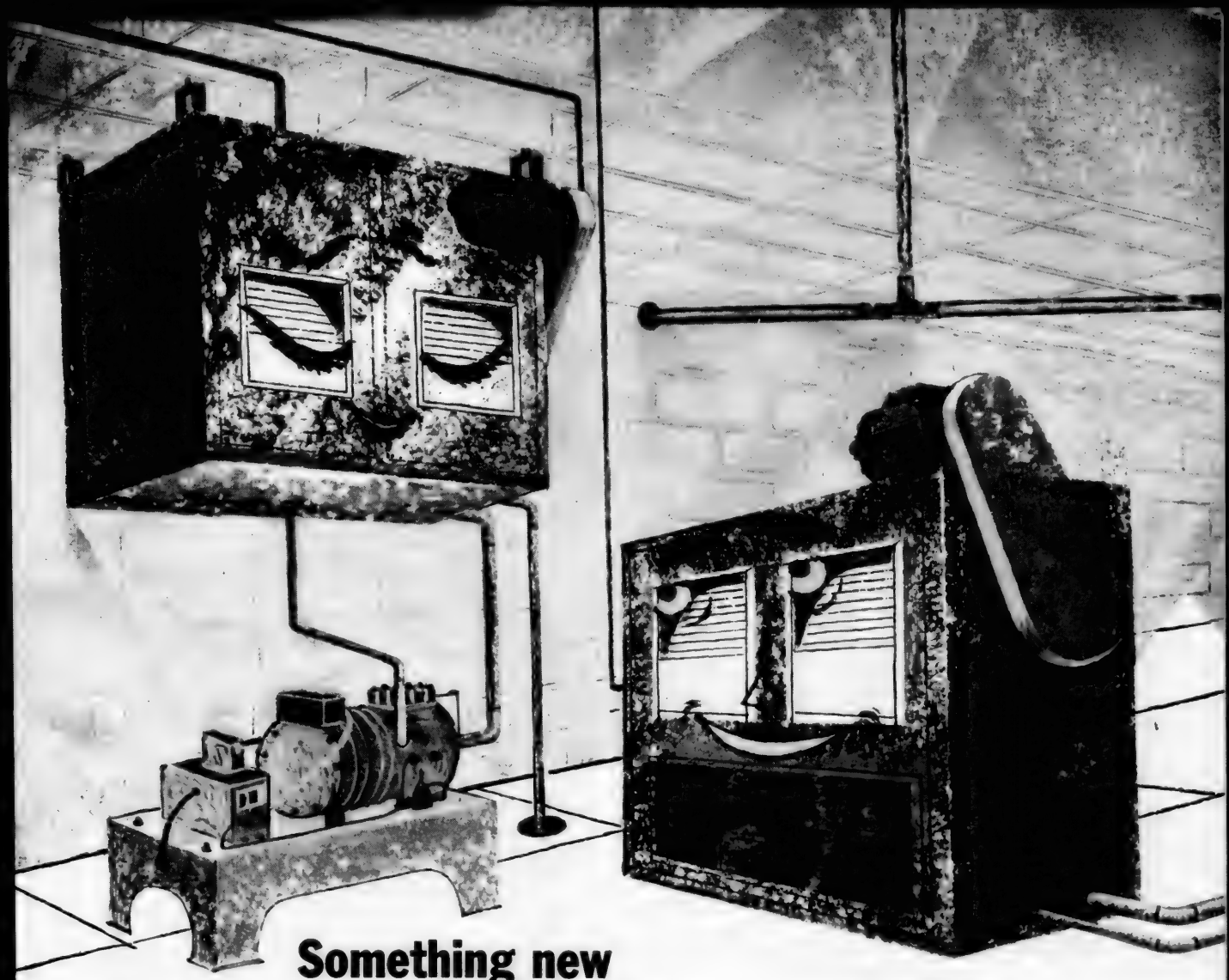
Insertion-type, vapor-actuated dial thermometers for duct installations feature ease of reading and dependable accuracy throughout the entire working range, a progressively graduated scale for use in the upper two-thirds range, and all brass fittings. They are manufactured by Weksler Instruments Corp., Freeport, N. Y.



These gages are enclosed in black enameled aluminum cases with brass slip rings, and are furnished with a sensitive 6- or 12-inch air bulb with a union connection flange to prevent air leakage, and an extension neck where insulation is present. They are also available with a small bulb and uncompensated lines up to 150 ft in length. Case design permits installation for adjustable angle, rigid or remote reading.

More information? Circle Item 48, postcard, last page.

(Continued on page 118)



Something new for the air conditioning boys... and coils!

Now, Air Handlers from Halstead & Mitchell in 880 to 47,500 CFM Range

AH Series Air Handling Units

Before you buy any Air Handler, check and compare these new H&M units, feature for feature and price for price.

See how easily H&M Air Handlers accommodate matching cooling and heating coils, with space for up to 12 rows of coil depth overall! If you like, H&M coils (from 2 to 68 square feet of face area) can be factory-installed, leaving protruding connections on either side for easy hook-up. Halstead & Mitchell makes the coils you need to match: direct expansion, chilled water, hot water, standard or non-freeze steam. Filter sections are also available.

Performance? H&M Air Handlers deliver air against static loads up to 2-inches water gauge, and do it quietly.

Construction? They're the sturdiest units in the field. Forward curved centrifugal blowers are enclosed in a heavy gauge cabinet featuring formed steel corner posts and flush mounted panels.

Price? Just ask your H&M distributor. You'll be pleased. He has all the engineering information, too. Or, you can write for Bulletin AHU-100, Halstead & Mitchell, Bessemer Building, Pittsburgh, Pa.

HM

Halstead & Mitchell

Air Handlers • Finned Coils • Air-Cooled Condensers • Cooling Towers • Water-Cooled Condensers

(Continued from page 116)

Unit Rugged—Will Travel

A self-contained, air cooled air conditioning unit is produced by Airflow Co., Rockville, Md., for mobile, shipboard, airborne or stationary use. Designated MAC-7½, this air conditioner has been released for use by the military and military electronics industry.

Unit design includes such features as extreme temperature operation (+125 to −65 deg F ambient), unusually rugged construction, permanently lubricated bearings, automatic temperature control, cycling or non-cycling operation, military type finishes, built-in electric heaters and humidity controls and accessories, the company states.

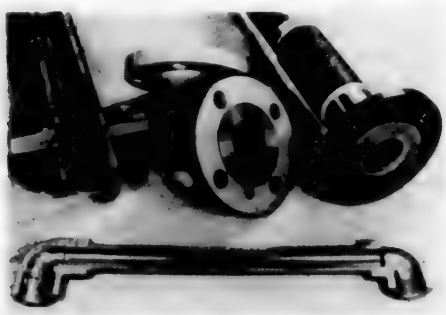
Designed to meet military specifications, unit is said to have been applied with exceptional success in instrumentation trailers for military use. It is available in several standard configurations and delivery can generally be made in thirty days. Cabinet is custom built, all welded, with an appearance which compliments its surrounding equipment.

More information? Circle Item 49, postcard, last page.

Plastic Fittings, Lined Pipe

Development of all-Penton and Penton-lined metal fittings and metal pipe with injection-molded Penton-lining for handling solvents and hot corrosive fluids in process piping is announced by Tube Turns Plastics, Inc., Louisville, Ky.

Penton, a chlorinated polyether thermoplastic credited with exceptional corrosion resistance and ability to handle elevated temperatures including low-pressure steam, is a registered trademark of Hercules Powder Company.



A complete line of the pipe and fittings is expected to have extensive uses in piping hot corrosive fluids in chemical processing industries; in drug manufacturing and other applications where high purity is essential at elevated temperatures; in chemical milling processing, used increasingly in aircraft industries for close dimensional milling of metallic parts by acid action; in petrochemical processing, and in handling hot corrosive paper and pulp industry solutions.

Both all-Penton and Penton-lined pipe and fittings will cost substantially less installed than metals, alloys and other materials conventionally used for process piping above the temperature range of unplasticized polyvinyl chloride and up to about 280 deg F, the company states.

More information? Circle Item 50, postcard, last page.

Electric Duct Heating System

An all-electric duct heating system for use in residences in connection with a central air conditioning unit is announced by York Div., Borg-Warner Corp., York, Pa.

The system is described by the company as the ultimate in safe, clean and flameless comfort air conditioning for year-round use under a wide range of climates.

The system consists of electric duct heating units of the kind illustrated, installed directly in the air distribution system, using the air moving equipment of a self-contained or remote air conditioner for distribution of heated air.

Use of individual room duct heaters located immediately before the outlet diffuser in the room, and controlled in the room by a separate thermostat, allows for complete flexibility in meeting individual heating requirements and minimizes operating cost, it is said.

A tempering heater is located in the main duct at the fan outlet to take the chill out of the air going to spaces where there is no call for additional heating. An interlocking relay is included in the assembly to prevent operation of the tempering heaters while the cooling unit is in operation.

According to the manufacturer, test installations show this to be the best and most economical all electric heating and cooling application available today.

In addition to its clean flameless heating, other advantages are: individual room control, low-voltage thermostat system, all air circulated and filtered, extremely low duct heat loss with units near outlet diffusers, a single model for requirements from 530 to 8,530 Btu per hr, engineered to provide cooling with either the company's self-contained Pathfinder or split-system Twinline air conditioning units.

More information? Circle Item 51, postcard, last page.

(Concluded on page 120)

RAY BURNERS WIN AT SQUAW VALLEY

Low Initial Cost
Right-Now Service
85%-Plus Efficiency

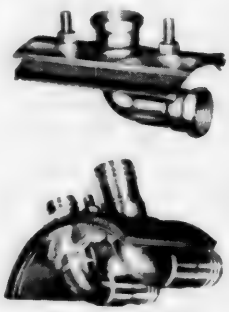
For the 1960 Winter Olympics site, burner reliability was a paramount consideration. From the start of the project, reliable Ray Burners were specified and purchased. The installed burners are complete—including controls and refractory—and, being forced draft, they eliminate unsightly stacks. The proven efficiency of Ray Burners allows use of low cost residual oils for operating economy at over 85 per cent efficiency. The Squaw Valley installation utilizes the Ray diesel ignition system—although gas-electric ignition is also available. All Ray Burners are factory piped, wired and tested prior to shipment. For complete information on Ray Forced Draft Burners, write for Catalog Unit Y.

RAY BURNER COMPANY
1301 San Jose Avenue, San Francisco, California
629 Grove, Jersey City, New Jersey

(Concluded from page 118)

Water Well Seal

J. G. Fischer, Inc., East Aurora, N. Y., announces a well seal which insures absolute protection against contamination of water supplies from drainage, insects and other foreign material entering the well casing. It has been tested and approved by health departments throughout the country.



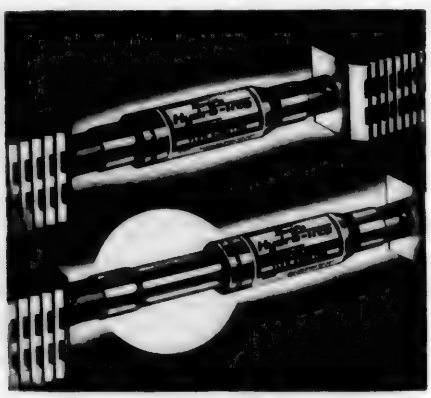
These water well seals are intended for below ground, side saddle entry into the well casing. It is adjustable so that it is easily adapted to steel, metal or tile casings. The resilient Neoprene gasket and plate are designed to insure an absolutely tight seal when drawn up against the casing interior. Thus, an absolute and permanent seal from dirt is assured.

It is available in a variety of sizes to fit 4 to 12-inch casings, and is designed for use with plastic or iron pipe. Single or double pipe models are available as well as a special design for use with submersible pump units.

More information? Circle Item 52, postcard, last page.

Leakproof Expansion Coupling

A guaranteed leakproof expansion joint, called Hydro-Tite, is offered by Slant/Fin Radiator Corp., Richmond Hill, N. Y. It permits greater thermal expansion than previously available, and its method of manufacture and operation in the field guarantees that it will outlive the system in which it is installed, according to the company.



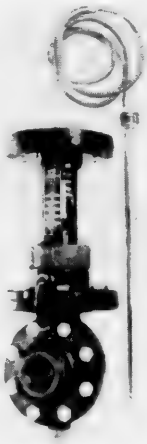
Its proper use will eliminate leaks, breaks and failures due to expansion and contraction strain. It relieves pressure from piping and joints and eliminates the noises normally associated with expansion. Economical to install and requiring no maintenance, it can be used for low pressure steam or hot water applications.

Available with sweat or threaded connections.

More information? Circle Item 53, postcard, last page.

Piloted Temperature Control

Piloted temperature control valves in ¼ to 2-inch sizes are available from OPW-Jordan Div., OPW Corp., Cincinnati, Ohio. Designed for sensitive control of rugged pressure drops, this type unit is widely used in industry to control temperatures of instantaneous heaters, oil preheaters, storage heaters and process heating and cooling applications, the company explains.



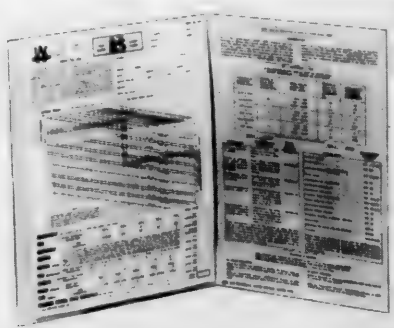
Sliding gate, self-lapping, self-cleaning seats are said to insure positive and tight shut-off during lock-up and accurate regulation during operation. Units are available from stock in ductile iron and bronze bodies, suitable for pressures to 250 psi and temperatures to 500 deg F. There are ten temperature control ranges, from 35-450 deg. Capacities range from 12 to 6600 lb steam per hr or 1 to 175 gal of water per min, depending on pressures.

Capable of accurate control with a pressure differential across seats of 125 psi.

More information? Circle Item 54, postcard, last page.

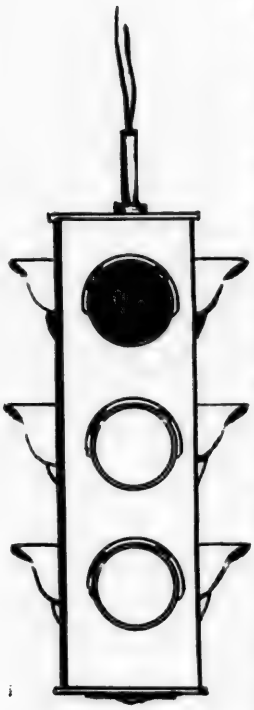
Form Simplifies Silencer Selection

A "short form," designed to simplify selection of silencer units, is announced by Air Conditioning Dept., Industrial Acoustics Co., Inc., 341 Jackson Avenue, New York 54, N. Y. The form enables engineers and contractors to quickly and accurately determine the type and number of silencing units required for any air handling system.



It consists of a binder and pad of 25 reproducible work sheets. In working out the noise reduction requirements step-by-step on the form, anyone can determine the exact size, model and number of "packaged" unit silencers required for any particular system.

Copies of the form are available from the company at the nominal cost of one dollar per copy.



STOP

BACKWATER

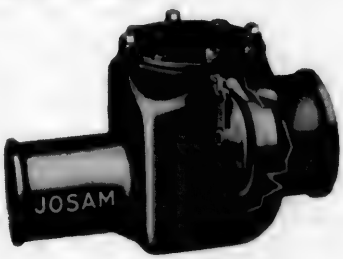
INSTANTLY

Josam

BACKWATER VALVES

These pictures taken from newspaper stories in recent months show what can happen when backwater suddenly erupts within a building. They dramatically prove how floors, walls, furniture and expensive equipment are subjected to the ravages of backwater if a flood due to rain or snow is heavy enough to cause sewers to back up. The way to provide complete protection is to install a Josam Backwater Sewer Valve — permits constant drainage to sewer yet prevents the entry of any backwater or sewage into basement.

Recommend them on every job — the cost is so little compared to the damage they prevent. Send coupon for Manual BW on "Backwater."



Series No. 1170-T

JOSAM MANUFACTURING CO.
General Offices and Manufacturing Division
MICHIGAN CITY, INDIANA
REPRESENTATIVES IN ALL PRINCIPAL CITIES

West Coast Distributors
JOSAM PACIFIC CO.
765 Folsom Street San Francisco 7, Calif.

Josam Products are sold through plumbing supply wholesalers.

JOSAM MANUFACTURING CO.
Dept. HV-2 Michigan City, Indiana

Please send free copy of Manual BW on "Backwater"

Firm .....

By ..... Title .....

Address .....

City ..... Zone ..... State .....

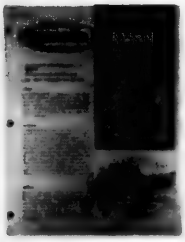
NEW LITERATURE

Use the prepaid postcard on last page for securing your copies of these catalogs.

Air Distribution Equipment

Data and pictures of its Uni-Flo air distribution equipment are contained in an 8-page condensed catalog published by Barber-Colman Co., Rockford, Ill. Sidewall, ceiling and floor diffusers, high velocity equipment and accessories are covered in Catalog F-4471-6.

Circle **Item 55** on Inquiry Card



Automatic Package Boilers

Tabulated data on 35 models of Continental automatic package boilers, ranging from 15- through 600-hp sizes, are contained in 4-page Bulletin BE-400, published by Boiler Engineering & Supply Co., Inc., Phoenixville, Pa. Includes output conversions, dimensions, weights, fuel consumption.

Circle **Item 56** on Inquiry Card

Water, Direct Expansion Coils

Young Radiator Co., Racine, Wis., offers a 28-page catalog which contains complete information on water (heating and cooling) and direct expansion refrigerant coils. Catalog 5559 includes selection data, physical and performance data, mean effective temperature difference chart.

Circle **Item 57** on Inquiry Card

Bronze Valves

Gate, globe, angle and check valves in general, and the company's bronze valves in particular, are the subject of a 12-page catalog from Walworth Co., New York, N. Y. General discussion on each type of valve is followed by descriptions and pictures of the company's bronze models.

Circle **Item 58** on Inquiry Card

Gas-Fired Duct Furnaces

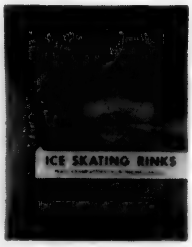
Features described as never before offered in a duct furnace are available in the line of gas-fired units manufactured by Modine Manufacturing Co., Racine, Wis. Six-page Bulletin 659B describes the duct furnaces and presents their advantages, dimensions, and performance characteristics.

Circle **Item 59** on Inquiry Card

Air Cleaning in Steel Mills

A 16-page brochure which discusses air cleaning requirements in steel mill operations is offered by American Air Filter Co., Inc., Louisville, Ky. Bulletin 234-Pl is designed for consulting engineers and plant engineers particularly concerned with air cleaning and mill ventilation.

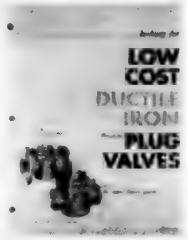
Circle **Item 60** on Inquiry Card



Ice Skating Rinks

Since pipe is a major component of the artificial ice rink, A. M. Byers Co., Pittsburgh, Pa., has maintained an active interest in the field of rink construction and maintenance. A 32-page report of the company's experience in this field is available. Actual installations are cited.

Circle **Item 61** on Inquiry Card



Ductile Iron Plug Valves

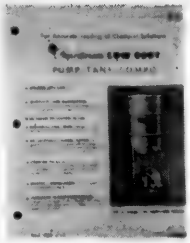
For service on water, oil, gas, chemical and other general purpose lines, Durco Sleeveline non-lubricated plug valves, with Teflon sleeves, provide positive shut-off. Manufacturer, The Duriron Co., Inc., Dayton, Ohio, offers a descriptive bulletin listing sizes and parts.

Circle **Item 62** on Inquiry Card

Technical Reports

Each Building Research Advisory Board publication results from a project designed to fill the needs of government or industry in the building field. A listing of these reports is available from BRAB, Washington, D. C. Subjects include air conditioning, air filtration, heating, piping.

Circle **Item 63** on Inquiry Card



Pump-Tank Combination

B-I-F Industries, Inc., Providence, R. I., announces a bulletin describing its new, low-cost Proportioneers Pump-Tank Combo for the accurate and efficient feeding of chemical solutions. Complete package includes tank, cover, stand, proportioning pump, and accessories.

Circle **Item 64** on Inquiry Card

Tube and Pipe Fittings

Publication of a 16-page catalog describing its complete line of brass tube and pipe fittings is announced by Brabant Brass Manufacturing Co., Detroit, Mich. Containing hundreds of detailed product illustrations and specifications, Catalog 60-2 has been specially organized for fast reference.

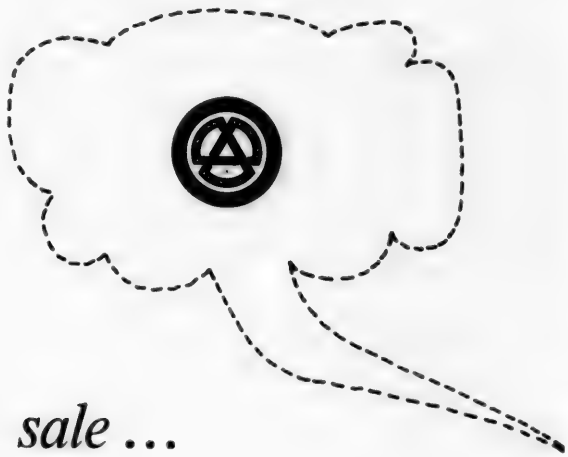
Circle **Item 65** on Inquiry Card

Infra-Red Heaters

Infratube zone-controlled heaters, which use a pure quartz tubing for the emitting element, are described in a 4-page bulletin by Apextro Products Co., div. of Apex Sheet Metal Works, Inc., Los Angeles, Calif. Included are selection data, capacities, and mechanical specifications.

Circle **Item 66** on Inquiry Card

(New Literature continued on page 124)



how to seal a sale...

This ARI Seal of Certification on unitary* air-conditioning equipment tells you—and your prospects—that it meets its published standards of performance.

With the ARI Seal on a unit, you can specify it with complete confidence. You know that the unit is built and backed by one of 46 companies who manufacture 90% of all unitary equipment sold. You know it is subject to intensive laboratory testing under adverse conditions and is rated to perform at maximum cooling capacity in the hottest, most humid weather.

ARI-certified equipment makes it easier for you on any job. It is easier to sell and to maintain. Once installed, you'll have fewer complaints from customers, fewer service calls, less repair and replacement expense—fewer headaches all around.

The ARI Seal of Certification on unitary equipment is an excellent sales closer. Put it to work for you next time you talk to a prospect.

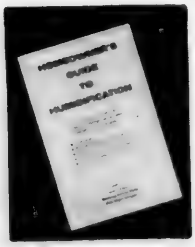
*"Unitary" air conditioners included in this program: all packaged air conditioners, whether single units or two-piece units (called "split" systems) up to 135,000 B.T.U.'s per hour in capacity, but not including room air conditioners. ARI Standard 210-58 for electrically-driven equipment; ARI Standard 250-58 for heat-powered equipment.

this seal helps you sell

For free explanatory booklet and Directory of participating manufacturers, write to: Chief Engineer, Dept. B-201, Air-Conditioning and Refrigeration Institute, 1346 Connecticut Avenue, N.W., Washington, D.C.

(Continued from page 122)

Use the prepaid postcard on last page for securing your copies of these catalogs.



Guide to Humidification

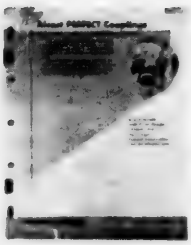
A factual discussion of humidification and its effects is offered by Armstrong Machine Works, Three Rivers, Mich., in a 16-page booklet. Titled Homeowner's Guide to Humidification, it includes an interesting section relating home construction to permissible relative humidity.

Circle **Item 67** on Inquiry Card

Air Processing Equipment

A 12-page bulletin from J. O. Ross Engineering, Div. of Midland-Ross Corp., New York, N. Y., contains six case histories covering tough drying or curing problems solved by properly engineered equipment. Includes data on ovens, dryers, air heaters, and curing systems.

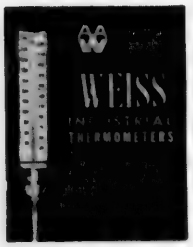
Circle **Item 68** on Inquiry Card



Steam-Traced Piping Couplings

Compact couplings for joining steam-traced aluminum piping are covered in Bulletin PF-1 by the manufacturer, Alcast Fittings, Claymont, Del. Two-page bulletin describes Perfect couplings, gives installation procedure, and lists dimensions and weights for ten available sizes.

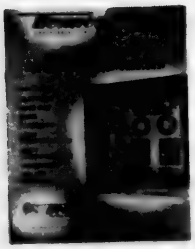
Circle **Item 69** on Inquiry Card



Industrial Thermometers

Asserting that temperature is the most important factor of all processing, working and storage conditions, Albert A. Weiss & Son, Inc., Brooklyn, N. Y., offers a line of precision-built industrial thermometers. Many styles and models are described in 16-page Catalog No. 260.

Circle **Item 70** on Inquiry Card



Walk-in Space Chambers

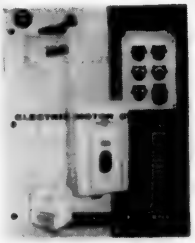
A 4-page bulletin describing the features and capabilities of walk-in space chambers is available from Tenney Engineering, Inc., Union, N.J. These chambers simulate a variety of conditions, including altitude, rain, humidity, low and high temperature, and solar radiation.

Circle **Item 71** on Inquiry Card

Explosion-Proof Controls

A 4-page booklet on explosion-proof controls, indicating, non-indicating and recording, has been prepared by The Partlow Corp., New Hartford, N. Y. These explosion-proof electric and pneumatic controls are available in a wide variety of temperature ranges up to 1100 deg F.

Circle **Item 72** on Inquiry Card



Electric Motor Controls

Furnas Electric Co., Batavia, Ill., announces a 72-page motor control catalog, No. 5900, that provides a condensed but thorough listing of general products, some of which are new. Coverage includes manual starters, magnetic controls, drum controllers, pressure switches, and pilot devices.

Circle **Item 73** on Inquiry Card

Air Conditioning Valves, Fittings

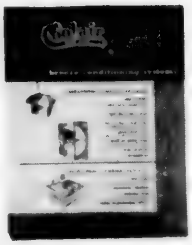
Superior Valve & Fittings Co., Pittsburgh, Pa., announces 20-page Catalog R-7 describing the company's line valves, globe valves, relief valves, heat exchangers, check valves, SAE flare fittings and related brass products. Includes data on sizing and application of valves and components.

Circle **Item 74** on Inquiry Card

Glass Pipe and Fittings

Design, engineering and installation data for Pyrex "Double-Tough" glass pipe and fittings make up 44-page Manual PE-3 published by Corning Glass Works, Corning, N. Y. Includes general information, selection data, engineering recommendations, and installation techniques.

Circle **Item 75** on Inquiry Card



Fans and Ventilators

Industrial, commercial and residential cooling systems based on the company's Coolair fans and ventilators are described in literature available from American Coolair Corp., Jacksonville, Fla. Equipment includes power roof ventilators, wall fans, wall shutters and accessories.

Circle **Item 76** on Inquiry Card

Thermostatic Shower Mixing Valve

Suited for hospitals, clinics, hotels, motels, schools and institutions, as well as for private homes, its Recesso recessed thermostatic shower mixing valve is described in a 4-page bulletin by Lawler Automatic Controls, Inc., Mt. Vernon, N. Y. Installation details are included.

Circle **Item 77** on Inquiry Card

Gas-Fired Infra-Red Heating

Panelbloc Div., Bettcher Mfg. Corp., Cleveland, Ohio, announces a 16-page booklet on gas-fired infra-red heating of industrial and commercial buildings. Booklet describes infra-red heating, and illustrates, with formulas and equations, various methods of calculating infra-red requirements.

Circle **Item 78** on Inquiry Card

(New Literature continued on page 126)

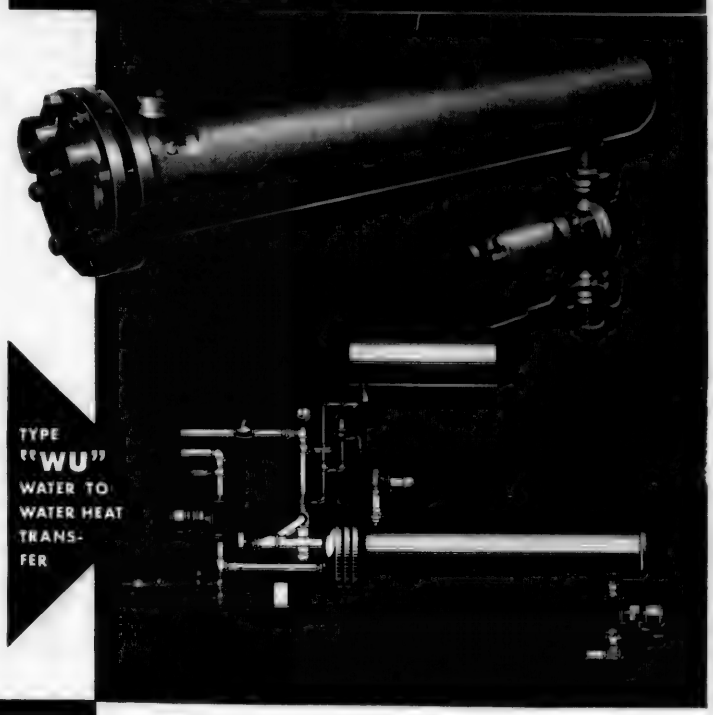
A.S.M.E. CODE

When you install a B&G Heat Exchanger, you have assured yourself of not only high efficiency, but highest quality construction.

With each B&G Exchanger, a Manufacturer's Data Report for Unfired Pressure Vessels, Form No. U-1, as required by the provision of the A.S.M.E. Code rules, is furnished. This form is signed by a qualified inspector, holding a National Board Commission, certifying that construction conforms to the latest A.S.M.E. Code for unfired pressure vessels. The A.S.M.E. "U" symbol is stamped on each exchanger.

Heat Exchangers

FOR RADIATION AND WATER HEATING

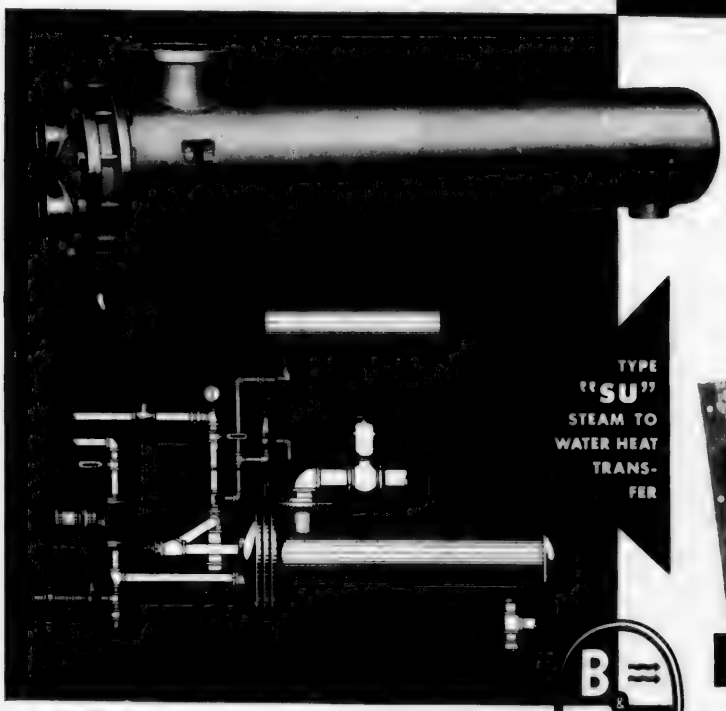


TYPE "WU" WATER TO WATER HEAT TRANS-FER

TYPE "WU"

The "WU" Exchanger is equipped with a B&G Booster which pumps boiler water through the shell, greatly increasing the capacity of the unit. An unbelievably small "WU" produces large volumes of hot water. Water temperature is closely controlled... the Booster starts whenever the water goes below the desired degree and continues to run until the water is again at the proper temperature.

When used as a service water heater, a storage tank can be eliminated, because the "WU" heats water as rapidly as it is used.



TYPE "SU" STEAM TO WATER HEAT TRANS-FER

TYPE "SU"

In buildings where steam is required for process use, the advantages of a forced hot water heating system can be obtained by installing an "SU" Exchanger instead of an extra boiler.

This exchanger also provides an efficient, low cost method of heating water for apartments, hotels, hospitals, industrial and processing plants. No storage tank is needed.

For complete information send for "WU" Catalog No. GC-1054 and "SU" Catalogs No. SC-159 and SI-159.

BELL & GOSSETT

COMPANY

Dept. GB-4, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

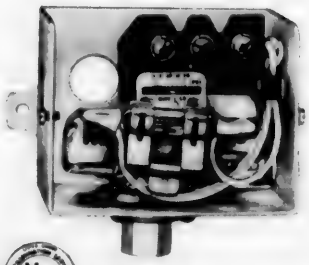
*Reg. U. S. Pat. Off.

NEW CATALOG AVAILABLE

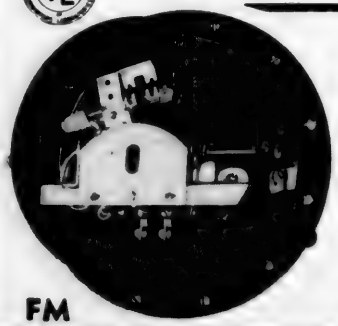
Fifty-six informative pages—controls for pressure, temperature, liquid level, mechanical movement—available with various case styles for indoor, outdoor or hazardous locations.

ASK FOR CATALOG NO. 860

CHECK THESE NEW PRODUCTS BY MERCOID



New SP-DT low pressure (instrument air) control. Small in size, light in weight. Provides any of following operations: SP cut-in high; SP cut-in low; or SP-DT operation. Two operating ranges 1 to 20 and 1 to 30 psig. External adjustments, visible dial and visible circuit position. See catalog No. 860



New low pressure diaphragm control for gases or air. Can be used three ways; for pressure, negative (vac.) pressure or differential pressure. External adjustments, visible dial and visible on-off circuit position. Two operating ranges, 1.0" to 30.0" and 1/2 to 5 psig. See catalog No. 860

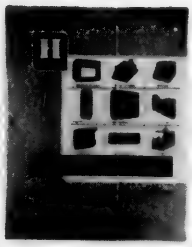
FM

THE MERCOID CORPORATION
4203 Belmont Avenue, Chicago 41, Illinois

New Literature

(Continued from page 124)

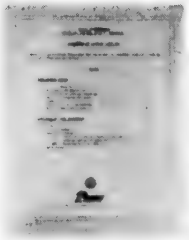
Use the prepaid postcard on last page for securing your copies of these catalogs.



Scientific and Test Instruments

Scientific and test instruments manufactured by Industrial Div., Minneapolis-Honeywell Regulator Co., Philadelphia, Pa., are the subject of 48-page Catalog G-10. Description, illustration, salient specifications, and reference for additional information are given for instruments.

Circle **Item 79** on Inquiry Card



De-icer Controls for Heat Pumps

How to test and apply the company's D50 and D52 type de-icer controls for heat pumps, which detect and clear outside coils of ice automatically in a wide geographic area, is described in 15-page Engineering Bulletin No. 1748 by Ranco Incorporated, Columbus, Ohio.

Circle **Item 80** on Inquiry Card

Hydrostatic Instruments

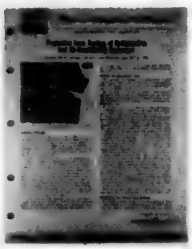
Installation information, plus design and construction features, for the company's line of hydrostatic instruments is contained in an 88-page handbook offered by Petrometer Corp., Long Island City, N.Y. Product information and application is supplemented by engineering data, tables.

Circle **Item 81** on Inquiry Card

Acoustical Treatment

A 4-page bulletin, S-10, on Cafco Sound-Shield, a mechanically applied, high sound absorption acoustical treatment for office buildings, hotels, stores, restaurants, schools and churches, is offered by Columbia Acoustics and Fireproofing Co., Stanhope, N. J.

Circle **Item 82** on Inquiry Card



Production Leak Testing

Bulletin GET-2938, from General Electric Co., Schenectady, N. Y., gives details of procedures and techniques for using halogen-sensitive leak detectors in production testing of refrigeration and air-conditioning equipment. Describes preparation of parts, calibration of detectors.

Circle **Item 83** on Inquiry Card

Protective Color Coatings

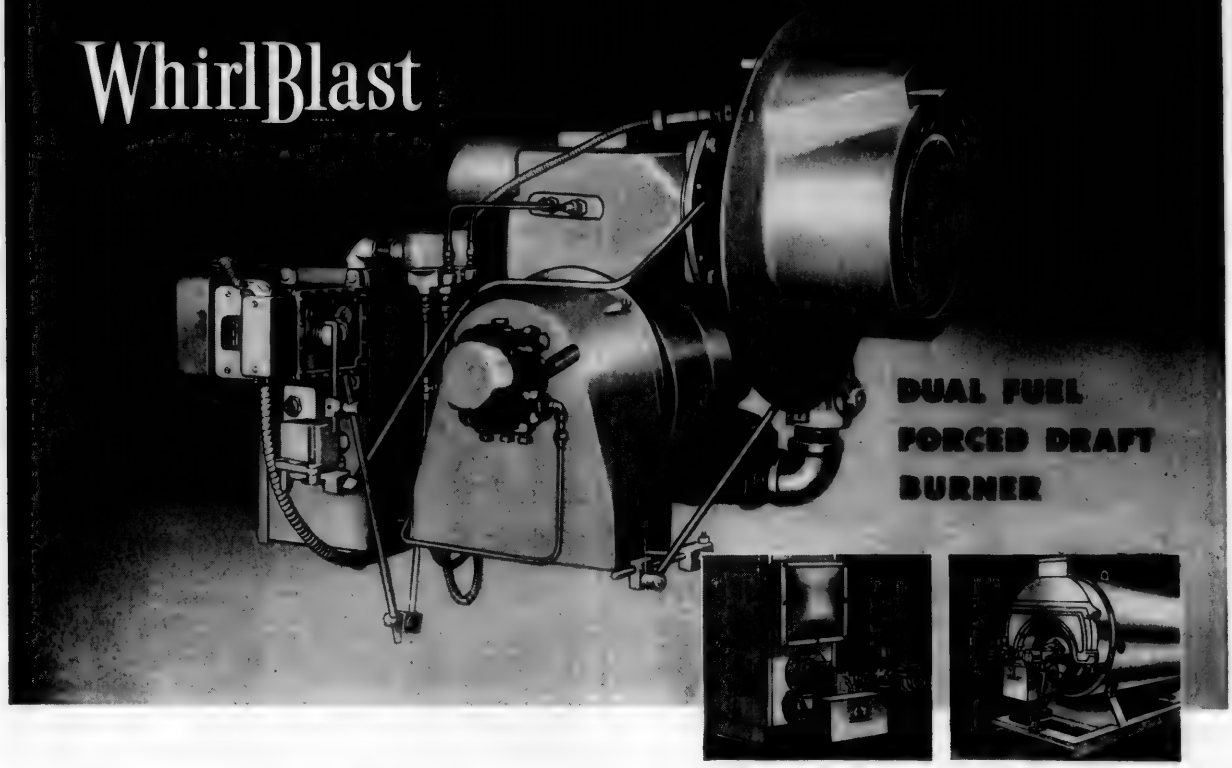
New Color Horizons is the title of a 38-page systems catalog published by Rust-Oleum Corp., Evanston, Ill. A comprehensive treatise on rust and corrosion control by protective coatings, it includes full-color application photos and color chips, plus a technical data section.

Circle **Item 84** on Inquiry Card

(Continued on page 128)

A new development by Iron Fireman

WhirlBlast



Makes firebox boilers super-efficient

NO SMOKE

Burns clean in less than 10 seconds. The WhirlBlast flame is brilliantly clean almost instantly, and stays clean. Although accepted standards of oil firing allow a 15 minute warm-up period, during which time smoke is tolerated, the Iron Fireman WhirlBlast burner is clean in seconds. Smoke and soot are unburned fuel—completely wasted by smoky starts.

NO STACK

Needs only an exhaust vent. Boilers with conventional burners require from 30 to 80 feet of stack or an induced draft fan. Sealed steel firebox boilers with WhirlBlast burners require only a small exhaust vent.

CONSERVES BOILER HEAT

Standby loss is almost nil. The highly efficient WhirlBlast burner does not need a refractory combustion chamber to "support combustion." Consequently there is no brickwork to store heat to be wasted during "off" periods. Standby heat loss is reduced to an insignificant minimum.

CUTS COSTS

Low fuel bills; low maintenance. Efficient combustion and low standby loss conserve fuel. Elimination of smoke and soot means no fouled boiler tubes, no carboned nozzles or electrodes; no refractory maintenance expense.

A COMPLETE PACKAGE

No special skill to install, adjust, service or operate. The WhirlBlast burner (for gas, oil or dual-fuel combination) comes from the factory fully wired and tested. Bolts to boiler front with firing head through fire door. No special combustion chamber or firing pit needed. Exceptional installation saving.

Send coupon for further information.

IRON FIREMAN®
AUTOMATIC FIRING EQUIPMENT
FOR HEATING, POWER, PROCESSING

IRON FIREMAN MANUFACTURING COMPANY
3082 W. 106th Street, Cleveland 11, Ohio
(In Canada, 80 Ward Street, Toronto, Ontario)

Please send me more information and specifications on the Iron Fireman WhirlBlast burner.

Name .....
Firm .....
Address .....
City ..... Zone ..... State .....

Symmons TUB-SHOWER

COMBINATION VALVE

simplified design provides full flow & temperature control

with Only ONE Moving Part

- A single handle selects the desired temperature and delivers the flow to the tub spout.
- Attached to the handle is a single spindle which controls volume and temperature. It carries both washers.
- A simple push-button unit diverts the tempered water to the Shower Head when desired, by simply pressing the Diverter button.
- Symmons Tub Shower is competitively priced, accurately machined and ruggedly constructed.
- Symmons is the simplest, most modern, most trouble-free mixing valve available today. It is designed for lifetime service.

See SWEET'S ARCHITECTURAL FILE, DOMESTIC ENGINEERING CATALOG or write us direct for further information

Symmons ENGINEERING COMPANY

Dept. 1-C, 448 C STREET, BOSTON 10, MASSACHUSETTS

Write today for Tub-Shower bulletin.

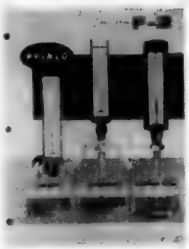
(Continued from page 126)

Use the prepaid postcard on last page for securing your copies of these catalogs.

Submersible Pumps

A condensed catalog of the 6-inch Dolphin submersible pump line is offered by Rapidayton Div., The Tait Manufacturing Co., Dayton, Ohio. Three series are shown: high head, mid-range, and high capacity. These pumps are designed for wells up to 800 ft in depth.

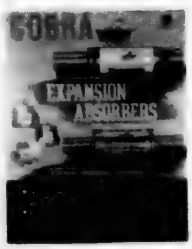
Circle **Item 85** on Inquiry Card



Industrial Thermometers

A 4-page bulletin, No. F-2, from Precision Thermometer & Instrument Co., Philadelphia, Pa., describes and illustrates industrial thermometers in air duct and moisture-proof models, plus an easily positioned MultiForm model that saves on installation costs and reduces stocking requirements.

Circle **Item 86** on Inquiry Card



Expansion Absorbers

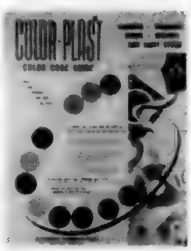
Catalog KE-99, published by Cobra Metal Hose, Chicago, Ill., serves to introduce the company's two new expansion absorbers. One is a sliding piston type unit, the other, a bellows type unit; both speed up installations and stop noises due to expansion. Installation recommendations included.

Circle **Item 87** on Inquiry Card

High Density Polyethylene Pipe

A stronger, more chemically resistant plastic pipe (Grex high density polyethylene) is described in 8-page brochure from Polymer Chemicals Div., W. R. Grace & Co., Clifton, N. J. Includes data on raw materials, extrusion techniques, long term testing, joining, supporting, applications.

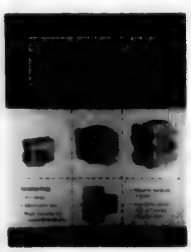
Circle **Item 88** on Inquiry Card



Shim and Gasket Selection

A new edition of its color code guide, designed to facilitate selection of the various gages of Color-Plast shim and gasket material by color identification, is announced by General Gasket Inc., Middletown, Conn. Material is available in roll or sheet form.

Circle **Item 89** on Inquiry Card



Control Valve for Softeners

Monotrol, a new single control valve for zeolite softeners, ion exchange units and filters, is the subject of Bulletin WC-122, available from Graver Water Conditioning Co., New York, N. Y. Bulletin discusses design, operation and construction details of the cast iron or plastic unit.

Circle **Item 90** on Inquiry Card

(Concluded on page 130)

"from Chicago"

sealtrode

Trademark

SEALED ELECTRODE FLOATLESS PUMP CONTROLLER

A new and valuable accessory for Sewage And Drainage Sump Pumps . . . exclusively available with "Chicago" Pumps.

SIMPLE OPERATION

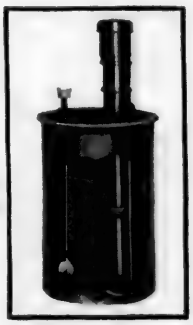
No moving parts in the liquid. As liquid level rises in the wet well it exerts a hydrostatic pressure on a flexible bulb filled with a electrolytic solution of clear water and copper sulphate. The hydrostatic pressure squeezes the bulb, causing the solution to rise in the support pipe. The liquid level in the support pipe will always equal the liquid level in which the controller is submerged, since the density of both liquids are equal. As the liquid within the support pipe rises and falls, it makes and breaks electrical circuits with the electrodes, activating the pump starters through controller relays.

The SEALTRODE* Sealed Electrode Floatless Pump Controller has every advantage of other floatless controllers, plus these advantages of being sealed:

- Electrodes never become insulated and coated with grease, oil or soap.
- Electrodes are never affected by corrosive elements in sewage and drainage water.
- No moving parts in liquid.
- Low original cost . . . eliminates need for dupiex float switches and float guide pipes.
- Low maintenance cost.

TYPICAL PUMP APPLICATIONS

SEWAGE PUMP **SUMP PUMP**



PATENT No. 2,797,702

Write direct, or contact Chicago Pump Company Distributors located in most principal cities, for bulletins and complete engineering data.

Putting Ideas to Work

FOOD MACHINERY AND CHEMICAL CORPORATION

Chicago Pump Company

6222 DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

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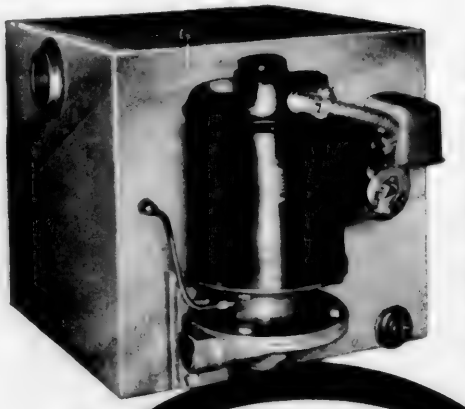


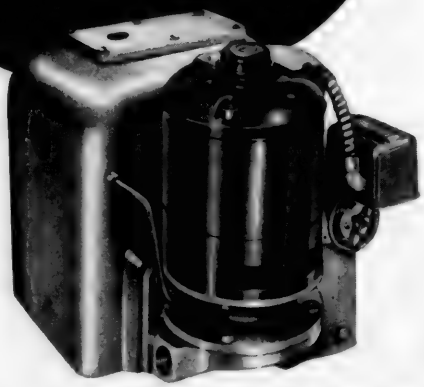
4100 Series STEEL TANK

Efficient in operation . . . neat and compact in design. Easy to service . . . all principal parts — motor, pump, float switch, drain plug — at front of tank.

Sterlco®

low pressure condensate pumps

CAPACITIES: 2000 TO 15,000 SQ. FT. E.D.R.



4200 Series CAST IRON TANK

Exactly the same design and performance as the 4100 series, except for cast iron tank where necessary or desirable.

Sterlco pumps are specially engineered . . . they are not adaptions of industrial or water supply pumps. Both series can deliver full rated output continuously, for long periods. Efficient impeller design prevents serious overloading of motors under any conditions.

SPECIAL APPLICATIONS — *For boiler return systems, greater capacities, or higher pressures, the 3500 series is available. It can be built to handle any job.*

Ask your plumbing and heating distributor, or write us for complete information!

Leaders in temperature controls since 1916

Sterling inc.

5206 West Clinton Avenue Milwaukee 23, Wis.

New Literature

(Concluded from page 128)

Use the prepaid postcard on last page for securing your copies of these catalogs.

Unit Air Filters

A 12-page composite product bulletin, describing the construction and application of permanent washable unit air filters, is offered by American Air Filter Co., Inc., Louisville, Ky. Bulletin No. 207 reports filter maintenance methods and equipment necessary, along with installation data.

Circle **Item 91** on Inquiry Card

Blower Housings

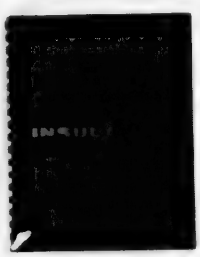
Pre-engineered blower housings for blower wheels ranging from 3- through 11-inch diameters and completely adaptable to any width single- or double-inlet wheel are described in a 16-page catalog available from Detroit Stamping Co., Detroit, Mich. Dimensional specifications are included.

Circle **Item 92** on Inquiry Card

Incinerators

Morse Boulger, Inc., New York, N. Y., announces a bulletin describing and illustrating its line of incinerators for commercial, industrial and domestic use. Charts and cross-reference tables to determine what type and size of incinerator will handle any given material are included.

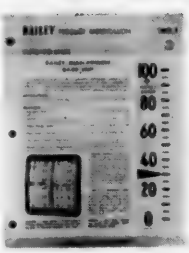
Circle **Item 93** on Inquiry Card



Thermal Insulations

Thermal insulations for all commercial and industrial requirements are described in 54-page Catalog IN-244A published by Johns-Manville Sales Corp., New York, N. Y. It contains 6 complete sections, each providing data on a specialized group of insulations.

Circle **Item 94** on Inquiry Card



Multi-Pointer Gage Unit

Multi-pointer gage units, used for pressure and level measurements, and pneumatic transmitting or receiving, are described in 4-page Product Specification M42-2 from Bailey Meter Co., Cleveland, Ohio. Actual-size drawing of 7-inch indicating scale is included to illustrate easy readability.

Circle **Item 95** on Inquiry Card

Electronic Air Cleaner

A 12-page bulletin, No. 405, containing complete information on its Hi-Velocity electronic air cleaner is available from Dollinger Corp., Rochester, N. Y. Air cleaner, which features unit construction, is available in six models, either field assembled or in cabinet unit form.

Circle **Item 96** on Inquiry Card

*ONE MILE OF STRIPLINE (slot type) DIFFUSERS

Architects — Perkins & Will, Chicago, Ill.
Air Conditioning & Ventilating Contractors — The Robert Irsay Co., Skokie, Ill.
General Contractors—Turner Construction Company

Installed in Administrative and Research Center

INTERNATIONAL MINERALS & CHEMICAL CORPORATION

Skokie, Illinois

STRIPLINE . . . Versatile, Inconspicuous, Practical

all photos by Hedrich-Blessing, Chicago

Stripline slot type diffusers guarantee the greatest possible uniformity of air flow while enhancing the modern architectural design.

Regardless of length of the Stripline diffusers installed, these slot type units provide unvaried distribution of noiseless, draftless, conditioned air. Cold or hot spots are completely eliminated.

Stripline is versatile . . . inconspicuous . . . practical . . . , can be located anywhere to suit the interior design . . . in walls . . . ceilings . . . coves . . . moulds . . . window stools.

For complete engineering data ask for Stripline catalog.

air diffusers • filters • exhausters
registers and grilles

Sold exclusively by representatives for:

AIR DEVICES INC.

185 MADISON AVENUE, New York 16, N. Y.

International-LaMont LEADS THE WAY

TYPICAL INSTALLATIONS

INDUSTRIAL & COMMERCIAL
Douglas Aircraft Corp.
Continental Can Co.
Union Carbide Nuclear Co.
Bahr-Manning Co.
Johnson & Johnson
American Airlines Inc.
Bethlehem Steel Co.
New York International Airport
Ohio Instrument Life Insurance Co.
Trans-Canada Air Lines
Bethlehem Pacific Coast Steel Co.
International Min. & Chem. Corp.

HOSPITALS
N. E. Florida Mental Hospital, Fla.
The Children's Hospital, Ohio
Bronx State Hospital, N. Y.
Loring AFB Hospital, Me.
Hadassah-Hebrew Medical Center, Israel

SCHOOLS & UNIVERSITIES
Rutgers University, N. J.
Hillton Elem. School, Ohio
American River Jr. College, Cal.
Madison High School, Ohio
Brigham Young University, Utah
Indian Hill Elem. School, Ohio
Holy Apostles School, Wisc.
Maple Park Elem. School, Ohio
Everett High School, Mich.
Avondale Elem. School, Ohio
Orion Jr. High School, Mich.
Whitewater High School, Wisc.
College of Great Falls, Mont.
The Colorado College, Colo.
St. Joseph Seminary, La.
Blossom Hill School, Ohio
Plus 21 U. S. Air Force and Navy Bases

More than 130 International-LaMont High Temperature Water Generators already in operation have a total capacity exceeding THREE BILLION Btu/hr.

This unequalled acceptance underlines a significant point. It is not enough merely to heat and distribute water at temperatures to 430° F. or more. The *real* economy of HTW is in the *magnitude* of the temperature differential between boiler discharge and return water.

Making full use of the proven LaMont principles of forced recirculation, International-LaMont Generators permit temperature differentials to 200° F. or more with *no danger of thermal shock*. Here is the key to major capital and operational savings throughout the system. In addition, International-LaMont counterflow design assures optimum heat absorption and high operating efficiency.

Investigate the *true* economy of high temperature water in terms of International-LaMont Forced Recirculation Generators.

Get full details from your
INTERNATIONAL DISTRICT REPRESENTATIVE
or write for Bulletins 700 and 1000 today.

IBW BOILER BUILDERS SINCE 1886

THE INTERNATIONAL BOILER WORKS CO.

Steel Firebox Heating & Power Boilers • Low & High Pressure Water Tube Package Boilers • International-LaMont Forced Recirculation Generators • ASME Code Pressure Vessels & Welded Products.

890 Spruce St. East Stroudsburg, Pa.

Manufactured and sold in Canada under agreement with CANADIAN VICKERS LTD., Montreal, P. Q.

(Concluded from page 16)

UPVC FOUND SUPERIOR FOR CORROSIVE WASTE PIPING

A 1½-inch unplasticized polyvinyl chloride p-trap showed no sign of deterioration due to chemical attack or solvation in a 326-day test period at Speed Scientific School, University of Louisville. In the same location, the service life of a lead trap is said to be from six to eight months.

The test was conducted by Dr. C. A. Plank in cooperation with Tube Turn Plastics, Inc. Tray was installed in the drain line serving a general-purpose laboratory bench. Service conditions were those imposed by acids, solvents, and bases employed in routine chemical analysis, including acetic, hydrochloric, nitric and sulfuric acids, sodium carbonate, sodium hydroxide, ammonium hydroxide, sodium acetate, isopropyl alcohol, ethylene dichloride, various fatty acids, ethanol, dithyl ether, acetone, and toluene.

At one time, enough undiluted acetone was poured into the drain to form the liquid seal in the trap and left overnight, Dr. Plank reported. Later, concentrated toluene was placed in the trap for several days without flushing, with no adverse effect.

Dr. Plank concludes that under typical laboratory conditions involving ambient temperatures, gravity flow, and continuous flushing with water, UPVC has many advantages to offer. He said that the tests indicate UPVC may be safely used where acetone, toluene, and other aromatics will be encountered occasionally or used extensively in dilute solutions.

HEAT TRANSFER SYMPOSIUM

The Mechanical Engineering Department of the University of Florida, Gainesville, will hold its annual Heat Transfer Symposium on March 7 and 8 in room 512, Engineering and Industries Building.

Several sessions are planned, including Basic Principles, Temperature and its Measurement, Heat Exchangers, Graphical Methods, and The Hydraulic Analog.

Readers of ACH&V are invited to attend. Additional information may be obtained by writing Prof. John C. Reed, department head, or Prof. E. A. Farber, program director.

BRIEFLY STATED NEWS ITEMS

Inauguration of the Second Annual competition to honor the year's most outstanding contribution to the use, application, or metallurgy of copper and copper-base alloys has been officially announced by the COPPER & BRASS RESEARCH ASSOCIATION, 420 Lexington Ave., New York 17, N.Y. Winner of the 1960 competition will receive $1000 and a bronze award to be presented May 17 at the Association's annual meeting in Hot Springs, Va. Last year's award was given in recognition of the Seagram Building in New York, the world's first all-bronze skyscraper.

Entries and nominations may be submitted no later than March 31 in any one of several classifications. Primary consideration will be given to originality of design of new or established applications of copper, brass, bronze, or other copper-base alloys; development of new products or improvement of marketing techniques; contributions to the metallurgy of the copper metals; improvement of fabrication methods in the manufacture of copper-based products; and contributions to science or research through the application of the copper metals. . .

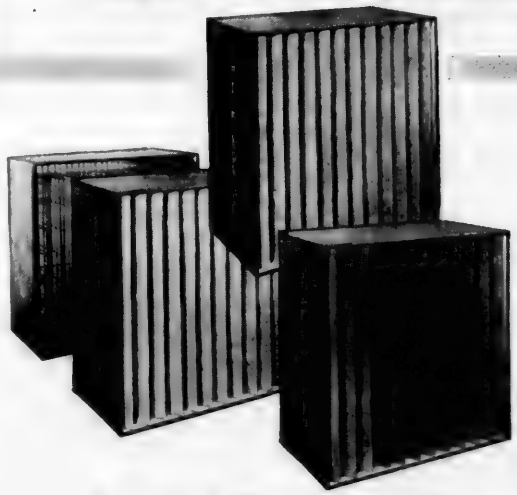
In January, RIC-WIL, INCORPORATED, Barberton, Ohio, celebrated its 50th anniversary. The company that began in 1910 as a one-room operation today boasts that it is the largest supplier of prefabricated, overhead and underground insulated piping systems, with eleven buildings covering 10½ acres. . .

The AMERICAN SOCIETY OF SANITARY ENGINEERING has awarded Chicago plumbing contractor John K. Dorsey the Henry B. Davis Merit Award for his contributions to the advancement of sanitation. Presentation was made by Arthur E. Whitney, ASSE national president, in Chicago.

Mr. Dorsey has devoted many years to local and national code and plumbing health problems. One

The Cambridge AEROSOLVE® Filter is the RELIABLE Filter

- High Efficiency
- Positive Filtration
- Low Pressure Drop
- Easy Installation & Maintenance
- High Velocity — 450 FPM
- Expert Technical Assistance



AEROSOLVE Filter Cartridges, all interchangeable, are available in efficiencies of 95%, 85%, and 35%, NBS test method with atmospheric dust.

Lowest Pressure Drop of Any Positive High-Efficiency Filter

TO BE SPECIFIC:

	AEROSOLVE 95	AEROSOLVE 85	AEROSOLVE 35
Average Discoloration Efficiency (N.B.S. Dust Spot Method)	95%	85%	35%
Static Pressure (250 fpm Models)	0.35" w.g.	0.22" w.g.	0.16" w.g.
Static Pressure (450 fpm Models)	0.45" w.g.	0.32" w.g.	0.25" w.g.

Minimum net filter area of 43 sq. ft. per 1000 CFM provides long life which, with low initial investment, guarantees economical owning and operating costs.

Write for Bulletin 132

Cambridge Filter Corporation
734 E. Erie Blvd., Syracuse 1, N. Y.

Pioneers in High Efficiency Air Cleaning

REPRESENTATIVES IN PRINCIPAL CITIES

of the many projects he researched was the matter of polio and its relation to improperly installed plumbing. He was recently appointed to the Illinois Plumbing Advisory Board which secured enactment of a plumbing code for the State last July.

Mr. Dorsey is past national president of ASSE, past vice-president and former member of the Board of Directors of the Plumbing Contractors Association of Chicago. . .

WITH THE ENGINEERS

Louis S. Oosten was appointed vice-president in charge of engineering for BELL & GOSSETT COMPANY, Morton Grove, Ill., succeeding Harold A. Lockhart who passed away recently. Mr. Oosten joined B&G in 1934 as a machine operator, was made a member of the engineering staff in 1935, and assistant chief engineer in 1942. . .

Carl L. Tucker has been appointed chief engineer of REMINGTON CORP., Auburn, N.Y., manufacturers of air conditioning equipment. Mr. Tucker joined Remington on February 1, 1959 as project engineer. In 1943 he had joined General Electric Company, where he remained until 1954 except for 17 months during which he was loaned to the Manhattan Project in Oak Ridge, Tenn. In 1954 he joined the air conditioning engineering department of the Emerson Radio and Television Corporation. . .

WILLIAM T. INGRAM, consulting engineer, with offices at 20 Point Crescent, Whitestone 57, N.Y., has opened a West Coast office at 90 Panoramic Way, Walnut Creek, Calif., with Fred R. Ingram as Associate in charge of that office. Professional services offered by both the East and West Coast offices provide sanitary engineering consultation concerned with control of environment and include water purification, sewage and industrial waste treatment, air pollution control, industrial hygiene, and related research planning and design. The

for FUME

CONTROL

install

FLEXAUST® HOSE

Made of strong neoprene coated cotton or nylon fabrics spiral wire reinforced.
For *all* kinds of fume and dust control, and ventilation uses.
Extremely flexible, durable, and lightweight.
Exceptionally easy to cut, install, connect, reuse, and relocate.
Sizes 1¼" thru 36" i.d.

Write for details today
Distributors in all principal cities

THE FLEXAUST COMPANY
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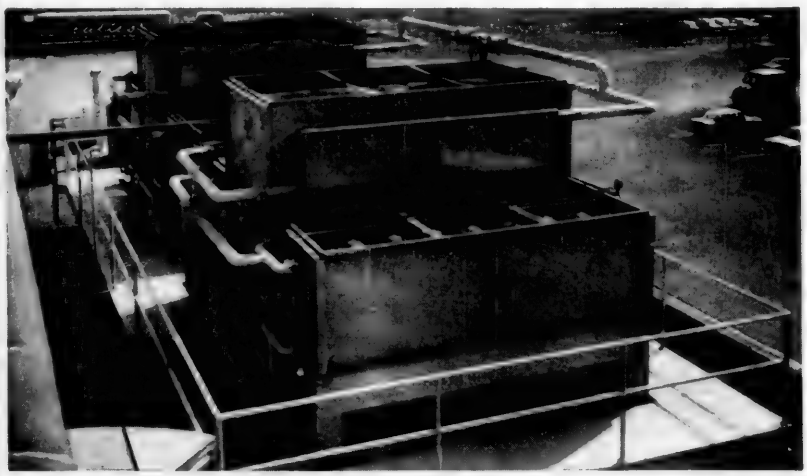


MODERN NIAGARA CONDENSERS PAY FOR THEMSELVES IN EXTRA SAVINGS

These Niagara condensers are lower in first cost and assure you of trouble-free automatic refrigeration. Special features: "Aeropass" coil removes super-heat to give you condensing at lower temperatures and prevent loss of capacity by the scaling of condenser tubes; "Oil-out", oil separator between pre-cooling and condensing coils gives you always an oil-free system; "Panel-Casing" construction gives you access to every part of the condenser for inspection and maintenance. Operating engineers say these condensers "save half the work of running a refrigerating plant". Managers who know costs and profits prove that Niagara condensers bring them great returns in power savings, water savings and reduced maintenance expense.

Write for Bulletins 131 and 142.

NIAGARA BLOWER COMPANY
Dept. HV-2, 405 Lexington Ave., New York 17, N. Y.
Niagara District Engineers in Principal Cities of U. S. and Canada

wide scope of service is made possible through the cooperation of professional specialist consultants in several areas including sanitary chemistry, meteorology, and mechanical engineering, who are associated with activities of either office as the need arises. . .

JAMES N. MORRIS, chief engineer of repairs and deputy director of GSA's Repair & Improvement Division, resigned from government service to devote full time to private practice in buildings management. He has supervised development, programming and coordination of GSA's annual programs of about $75 million in the repair and improvement of more than 5,000 government-owned buildings throughout the country for the past several years. He will direct the work of JAMES NEIL MORRIS & ASSOCIATES, buildings management consultants, 3304 Pendleton Drive, Silver Spring, Md. This firm will furnish across-the-board consulting services to schools, churches, hospitals, banks and other institutional facilities with emphasis on building maintenance and repair problems.

Arizona State Adopts Solar Unit

The ASSOCIATION FOR APPLIED SOLAR ENERGY has affiliated with Arizona State University. All correspondence should be addressed to the Association in care of Arizona State University, Tempe, Arizona. Affiliation means a complete administrative reorganization for the Association. Jan Oostermeyer, president for the past four years, has resigned and will be succeeded by Brig. Gen. Harold Walmsley, U. S. Army (retired). Mr. Oostermeyer will become a vice-president along with Walter Lucking, president of Arizona Public Service Co., and Henry Sargent, president of American and Foreign Power Co.

Dr. Alfred Stafford of the university's engineering faculty has been assigned as editor of AFASE publications, replacing Mrs. Jean Jensen. Edward Y. Harper, head of the AFASE Engineering Division, has resigned. A.S.U. will assign a qualified librarian on a full-time basis to the Association and possibly several other staff members.

For *Residential* INSTALLATIONS

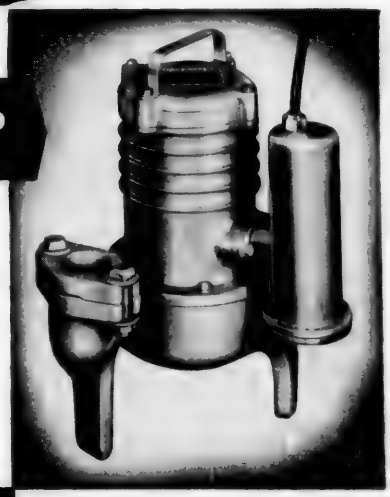
weil SUBMERSIBLES

NEW — Submersible SEWAGE PUMP and UL approved Submersible SUMP PUMP NOW IN JOBBERS' STOCKS

SEWAGE PUMP

2" Discharge
½ HP Capacitor Motor

This economical Sewage Pump permits installation of basement toilets and other fixtures where waste must be pumped up to sewer line.



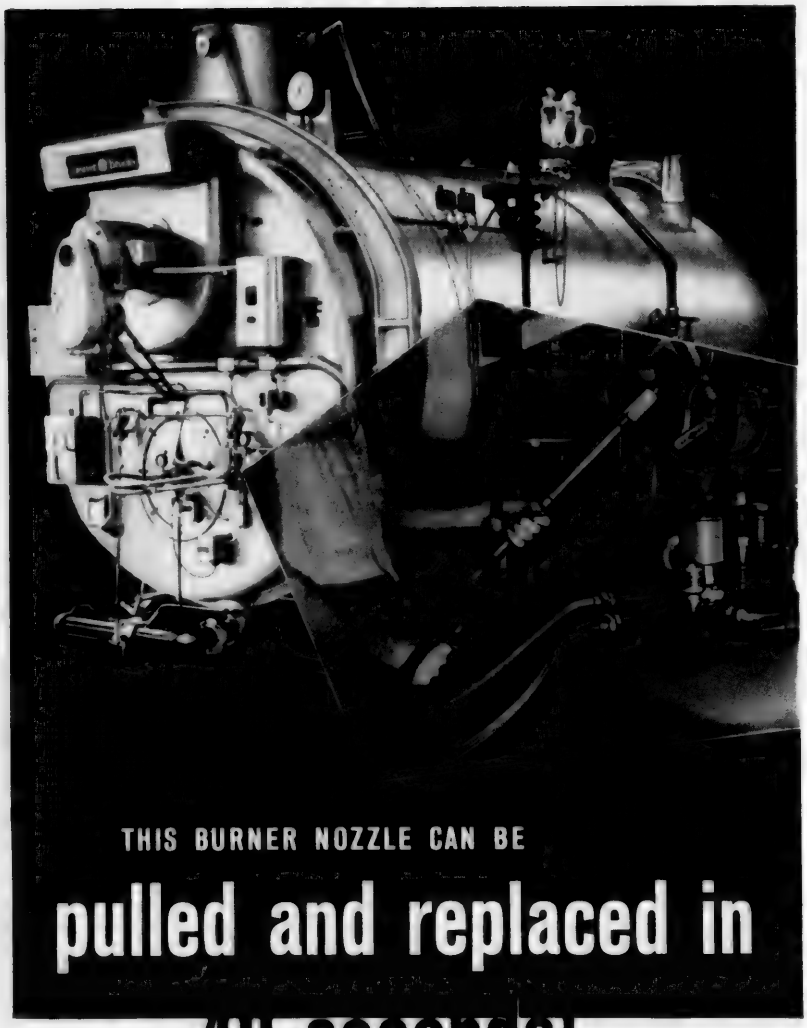
SUMP PUMP

1¼" Discharge
⅓ HP Capacitor Motor

Quiet Operating submersible pumps delight the homeowner!

Automatic MICRO-SWITCH control. Provides the proper pumping cycle.
Factory assembled, ready to run, just plug in. (No expensive wiring)
Dependable hermetically sealed motors assure performance at all times. When current fails moisture cannot damage pump or motor.

weil PUMP COMPANY
1516 NO. FREMONT ST., CHICAGO 22, ILL.



On both oil-fired and gas-fired CB packaged boilers, an integral burner puts you money ahead with clean, economical combustion

The photo above shows how easy it is to withdraw the retractable nozzle from the boiler without removing bolts or opening the front head. The whole job takes less than a minute. That's just one of the features of the remarkable integral burner in every Cleaver-Brooks packaged boiler.

The Cleaver-Brooks air-atomizing oil burner atomizes and burns fuel oils (even #6) with low pressure air. Nozzle design determines degree of atomization. No further adjustment is necessary to produce high CO_2. Spray pattern of oil forms at a uniform angle — axial with the furnace — eliminating carbon build-up. Controls on the CB boiler regulate oil viscosity and pressure to the oil-metering valve. Air and fuel are mixed to the right proportions for high combustion efficiency. Burner nozzle and piping are purged on each cycle.

A word about gas firing:
The gas burner on gas-fired CB boilers offers the same well-engineered design. Gas burner on even the largest CB boilers requires less than a pound of gas pressure to operate — an advantage when gas supply pressure is low. You can also select combination burners—quick change-over from oil to gas or reverse.

Write for more information today. Packaged fire tube boilers — sizes through 600 hp for steam or hot water. In larger capacities, Cleaver-Brooks offers Springfield packaged and field-erected water tube boilers. Cleaver-Brooks Company, Dept. B, 315 East Keefe Ave., Milwaukee 12, Wisconsin.

Cleaver Brooks

ORIGINATOR AND LARGEST PRODUCER OF PACKAGED BOILERS

Briefly Stated

BURGEONING BUSINESS

Henry R. Pataky has resigned as director of sales for a furnace manufacturer to become a manufacturer's representative. He has formed the H. R. PATAKY SALES AGENCY with offices at 2006 West Spring Street in Lima, Ohio. He will cover Ohio and the surrounding areas for manufacturers in heating and air conditioning and allied fields. Current lines include D. H. McCorkle Company, Standard Stamping & Perforating Company, and Rymco, Inc.

Crane to Buy National-U.S.

CRANE CO., Chicago, Ill., will acquire the operating assets of NATIONAL-U.S. RADIATOR CO., Johnstown, Pa., operating the company as a subsidiary or a division, retaining present National-U.S. management and employees. The merger will make a full line of plumbing and heating products available both for Crane and National-U.S. Radiator wholesalers.

Directors of Crane have also approved acquisition of the Autronic Division of The Swartwout Co., Cleveland, Ohio, maker of electronic controls. The Swartwout addition will facilitate the entrance of Crane into the field of valve automation. Operation of Swartwout will continue under the direction of Kenyon and Charles Swartwout.

B&G Acquires Colorado Research

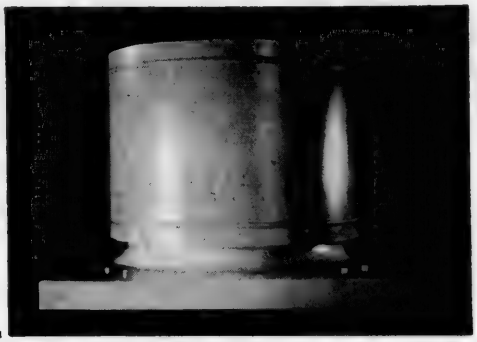
COLORADO RESEARCH CORPORATION, subsidiary of Carrier Corporation, has been purchased by BELL & GOSSETT CO., Morton Grove, Ill. Addition of Colorado Research, a leader in development of electronic devices, to Bell & Gossett's existing line of electronic items will enable the company to advance more rapidly in this field. In 1958, B&G, known principally as a manufacturer of heating and air conditioning equipment, acquired Dualex Corporation, after serving as its licensee for some years. Dualex pioneered a technique in electronic communications systems, based on vibrating reeds capable of transmitting messages.

(Continued on page 138)

NEW AXIAL ROOF VENTILATORS BY WESTERN

The Westernaire® Low Silhouette Hooded Exhaust Ventilator

The Westernaire® Low Silhouette Vertical Exhaust Ventilator



Above: A high efficiency power unit in a low, weather-proof housing. For both commercial and industrial use. 360 degree near horizontal discharge. Aerodynamically correct spun housing. Heavy guage steel, aluminum or non-corrosive Fiberglas* construction.

Low silhouette high efficiency power roof ventilators for vertical or horizontal air discharge provide motor mounting below the venturi to achieve styling compatible with modern architecture plus a smooth airstream discharge pattern.

Above: High capacity power unit specifically designed for industrial usage. Fumes, smoke, dust-laden and foul air projected high above roof to prevent re-entry into building. "Blow-open" dampers rest on neoprene seal. Completely weatherproof.

Other type ventilators include: Rotary, Stationary, Directional, Continuous Ridge, Unit, Power models.

WESTERN ENGINEERING & MFG. CO.

P. O. BOX 66455, LOS ANGELES 66, CALIFORNIA

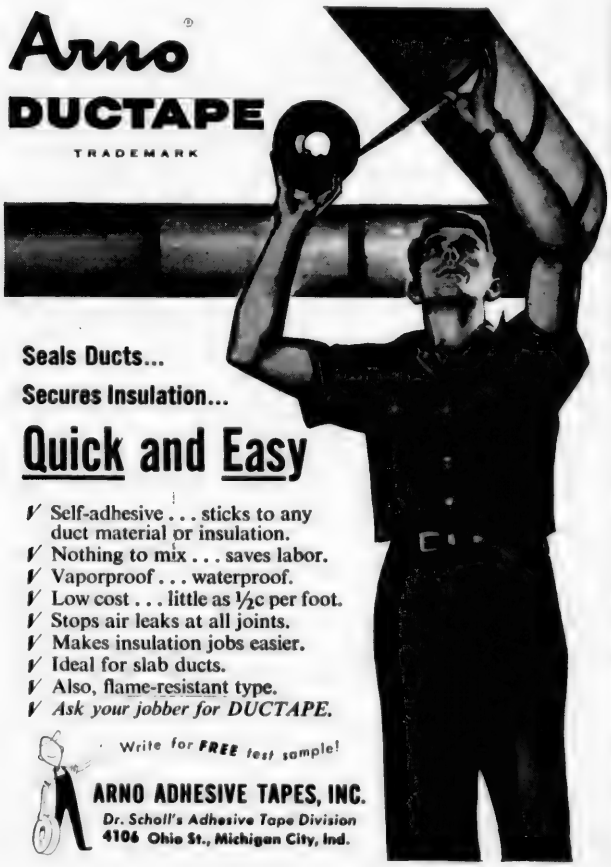
*TM- Owens Corning Fiberglas Corp.

Write for catalog and name of nearest representative

Since 1921

Arno® DUCTAPE

TRADEMARK



Seals Ducts...

Secures Insulation...

Quick and Easy

- ✓ Self-adhesive . . . sticks to any duct material or insulation.
- ✓ Nothing to mix . . . saves labor.
- ✓ Vaporproof . . . waterproof.
- ✓ Low cost . . . little as ½c per foot.
- ✓ Stops air leaks at all joints.
- ✓ Makes insulation jobs easier.
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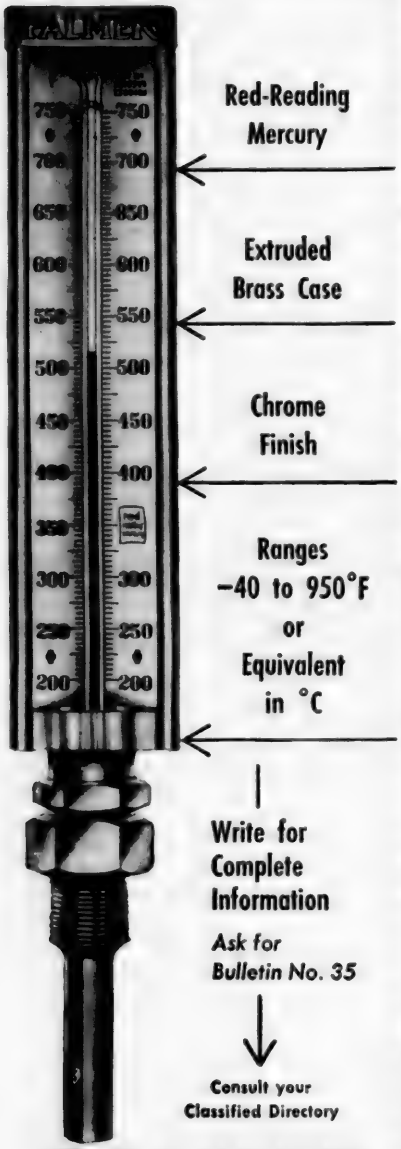
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Mfrs. of Industrial Laboratory, Recording and Dial Thermometers
Cincinnati 12, O.

Briefly Stated

(Continued from page 136)

Aeronca, Buensod-Stacey Merge

The boards of directors of AERONCA MFG. CORP., Middletown, Ohio, and BUENSOD-STACEY, INC., New York, N.Y., have approved a merger of the two companies subject to a vote of approval of the stockholders, scheduled this month. Buensod-Stacey, which will operate as a self-contained division of Aeronca, is a specialist in custom air conditioning systems, also assembling and selling all lines of air washers, humidifiers, dual duct units, including specialized sheet metal products for the air conditioning industry of its own fabrication. Founded in 1935, it has fabricating plants in North Carolina and The Bronx, N.Y.

Aeronca, founded in 1928, was the first producer of light personal aircraft, but since 1951 produces principally defense items. According to the company, it is the largest producer of stainless steel honeycomb structures, and is engaged in advanced research and production of ceramic adhesive sandwiches and the development of production processes for exotic metals.

Consolidation of Humphrey gas heaters into production of its line of gas equipment has been achieved by ARKLA AIR CONDITIONING CORP., Little Rock, Ark., and design work is near completion on the 1960 Humphrey heater line. At least one major model change is planned and other development work is under way, in keeping with Arkla's program to expand the Humphrey line to encompass the entire heating field. Arkla purchased the Humphrey heater business from General Gas Light Co., Kalamazoo, Mich., last spring. Humphrey's production facilities have been moved from Kalamazoo to Arkla's Evansville, Ind., plant, where they have been dovetailed with the manufacture of Arkla-Servel Sun Valley gas air conditioners, water chillers, gas lights, and gas signs. . .

MCGRAW-EDISON CO., Chicago, Ill., is liquidating its water heater business and had arranged with A. O. SMITH CORP., Kankakee, Ill., to handle service and warranty on heaters made under the Toastmaster and Tropic-Aire labels. Toastmaster and Tropic-Aire water heaters were made by the Clark Division of McGraw-Edison. The division will continue to manufacture bus air conditioning units and truck refrigeration units under the name TRANSPORTATION COOLING DIVISION. In announcing discontinuance of manufacturing as of January 31, Max McGraw, president, stated that this action came about because of the continuing unsettled condition of the water heater market and the substantial investment required to make glass-lined tanks, the use of which is greatly increasing. . .

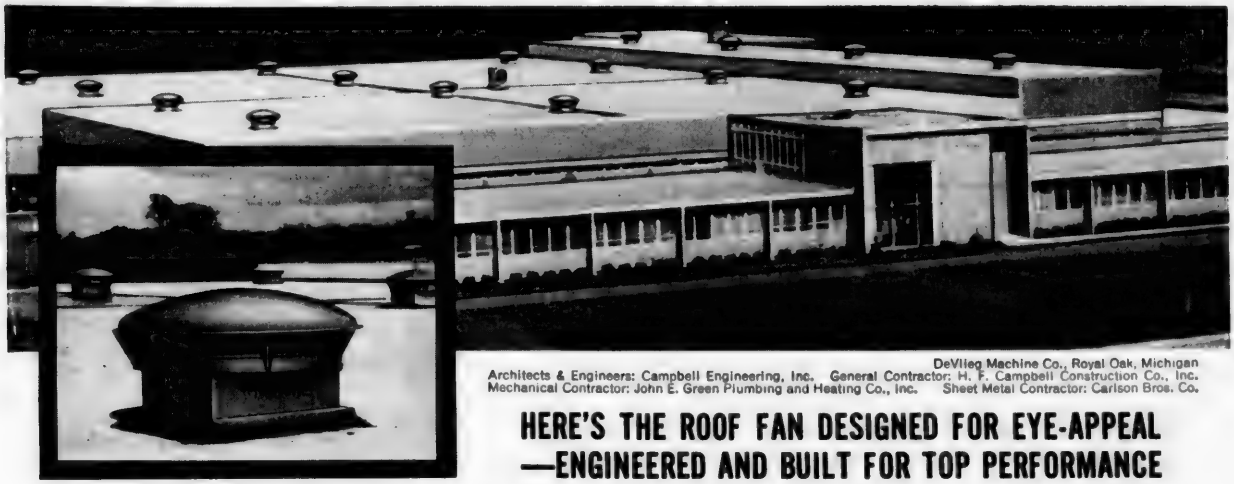
THE VILTER MANUFACTURING CO., Milwaukee, Wis., manufacturer of commercial refrigeration and air conditioning equipment, has announced the appointment of David N. McCormick as district manager of the firm's newly established Pittsburgh, Pa., office. The office has been opened to better serve customers and distributors in western Pennsylvania and New York. . .

AIR-FACTORS, INC., manufacturer of air distribution products, announces the transfer of the firm's operation to 1630 Industrial Park Ave., Covina, Calif. The 34,000-sq ft plant occupied by the company in Monrovia since 1951 was sold. The recently completed building is located in the Covina Industrial District, a planned industrial community. Covering 51,500 sq ft, the building includes 11,500 sq ft of office space with a testing laboratory, completely air conditioned with mechanical refrigeration. The factory space is maintained with an evaporative cooling system for summer comfort.

NAME CHANGES

HUPP CORP., Cleveland, Ohio, is shortening all of its divisional names, to reflect their integration into the corporation. Five of the company's seven operating divisions are affected by the move: GIBSON REFRIGERATOR DIVISION, formerly Gibson Refrigerator Company; HUPP AVIATION DIVISION, formerly

(Continued on page 140)



DeVilbiss Machine Co., Royal Oak, Michigan
Architects & Engineers: Campbell Engineering, Inc. General Contractor: H. F. Campbell Construction Co., Inc.
Mechanical Contractor: John E. Green Plumbing and Heating Co., Inc. Sheet Metal Contractor: Carlson Bros. Co.

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While the roof of this contemporary building demonstrates the low, attractive contour so much desired in a roof fan, it's the engineering under the hood that explains why the Allen "I-Line" is being specified by architects and engineers again and again.

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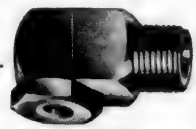

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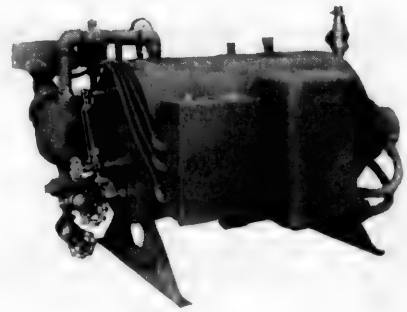

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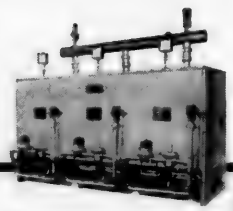

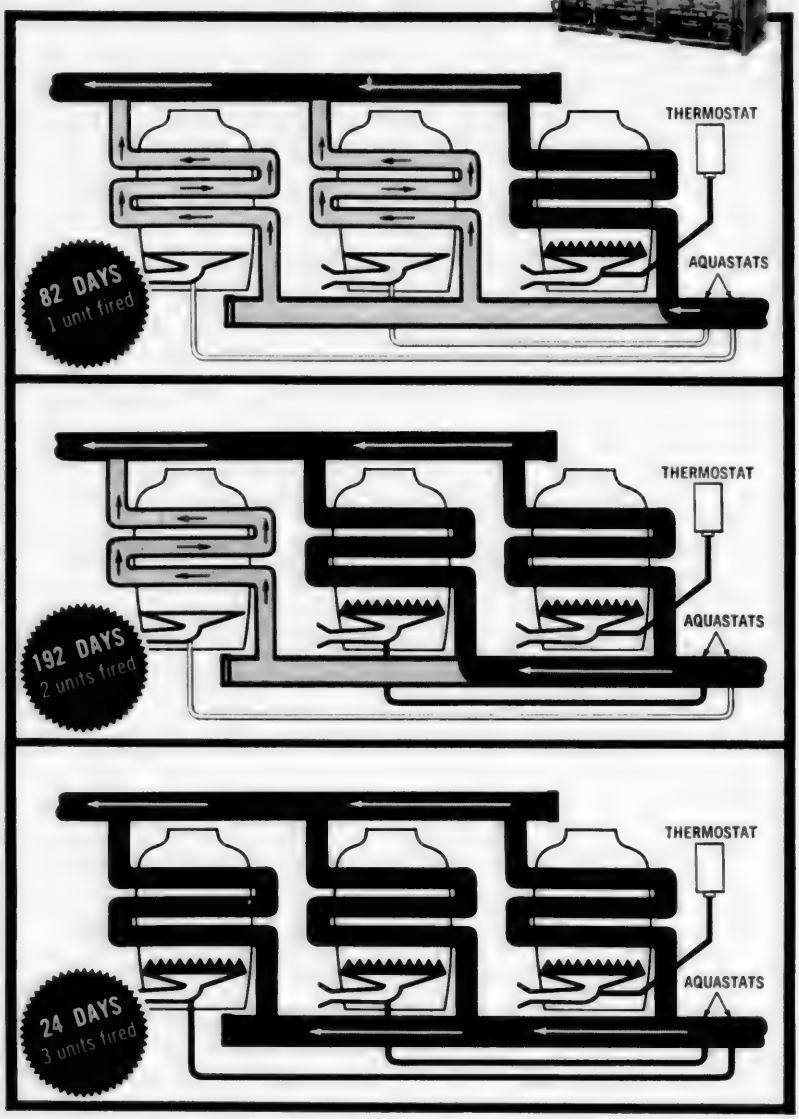

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Briefly Stated

(Continued from page 138)

Hupp Aviation Company; PERFECTION DIVISION, formerly Perfection Industries; TYPHOON AIR CONDITIONING DIVISION, formerly Typhoon Air Conditioning Company; and TYPHOON HEAT PUMP DIVISION, formerly Typhoon Heat Pump Company. Not affected are HUPPOWER DIVISION and HUPP INTERNATIONAL DIVISION. Hupp is engaged primarily in air conditioning, refrigeration and heating. It also manufactures aviation, automotive, hydraulic and marine products, operating eight plants in six states. . .

As of December 28, 1959, the name of Pennsylvania Range Boiler Co., Inc., Philadelphia, Pa., was changed to PENNSYLVANIA-BRADFORD APPLIANCE CORPORATION. The change reflects the change in the company's products. When established in 1881, its principal product was the range boiler. Today, the company manufactures a wide variety of domestic water heaters.

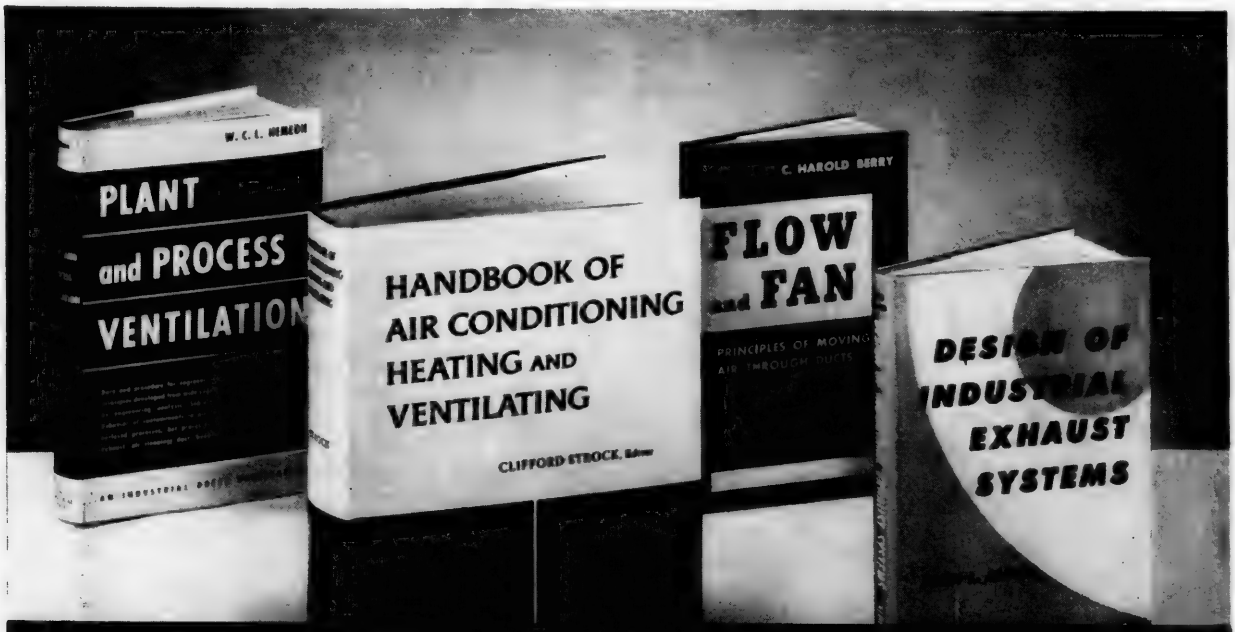
UP ON TOP

Appointment of John P. DeHetre as general manager of sales of THE YOUNGSTOWN SHEET AND TUBE CO., Youngstown, Ohio, is announced. He succeeds John M. Tuthill, who retired. . .

John R. Warnock, general manager of marketing; Richard L. Campbell, director of engineering; and George F. Butterfield, general manager of manufacturing, have been elected vice-presidents of DETROIT CONTROLS DIVISION OF AMERICAN-STANDARD, Detroit, Mich. Mr. Warnock started out in the company's Plumbing and Heating Division; Mr. Campbell had been a Vernatherm sales and product engineer; and Mr. Butterfield has been superintendent of the Columbus plant of the Detroit-based Industrial Division. A registered professional engineer in Ohio, he began in the company's air conditioning department.

Appointments of H. E. Rossell, Jr., as general sales manager, and R. J. Berkshire as general marketing manager, of AMERICAN-STAND-

(Continued on page 142)



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PLANT AND PROCESS VENTILATION. By W. C. L. Hemeon. 448 pages, 172 illustrations. The book and its author have contributed original ideas that have led to the modern engineering approach to ventilation design. The book covers fundamentals and properties of all types of air contaminants, a new treatment of dynamics of dust particles and the design of exterior hoods using a new conception enabling designer to estimate exhaust requirements of a cold, multi-directional process by observation. From chapters on estimation of exhaust, heat and general ventilation, the plant engineer can derive a sound, quantitative, independent judgment of factors pertinent to the design. Mr. Hemeon presents a theory for estimating air flow that is induced by the motion of solid particles. He reduces formulas to tabular and graphical form for direct application. Discusses application of behavior of hot contaminated air to design of canopy and exhaust hoods. From exhaust hood rates he leads into new equations to prevent contamination of process due to leakage. He also explains: methods of moving air, natural drafts, roof ventilation, large building air currents and exhaust air cleaning.

Theodore Hatch says, "In style and clarity of presentation, the author has succeeded in expressing some fairly subtle views in terms which will delight the engineer who wishes seriously to master the principles and practices of plant and process ventilation." $9.00

FLOW AND FAN. By C. Harold Berry. 232 pages, 84 illustrations. This basic text on air handling will help you solve your problems of moving air through ducts, selecting and controlling fans, duct arrangement and resistance, system characteristics and flow analysis. The two major divisions of the book cover the flow of gas through duct systems and fan performance and control. It covers the how and why behind basic calculations in the design of systems so that the information is applicable to actual ventilating problems. It presents elementary information and it treats subjects like equivalent orifice and the space-saving Gibson tapered enlargement, which are worthy of study by advanced engineers. You'll find FLOW AND FAN a practical, authoritative, yet interesting and entertaining book. $4.00

HANDBOOK OF AIR CONDITIONING, HEATING AND VENTILATING. Edited by Clifford Strock. 1094 pages, 518 illustrations. A wealth of working data for design engineers in ventilating, heating, air conditioning, piping and plumbing and related fields. 84 pages are devoted to air handling and ventilation and cover such subjects as air flow in ducts, duct friction losses, duct system design, determining required air volume, heat capacity of ducts, testing exhaust ventilating systems, corrosion of fans and ducts, exhaust hoods, weight of metal in rectangular ducts and circular ducts, weight of nonferrous sheets, commercial air cleaners, selector for air cleaners, fan arrangements, fans and blowers, threshold limits of toxic fumes and dust, dust collection. $15.00

DESIGN OF INDUSTRIAL EXHAUST SYSTEMS. By John L. Alden. Third Edition. 256 pages, 137 illustrations. Classic text on designing, building and buying industrial exhaust systems brought up-to-date to meet modern standards of industrial environment. Among the new advances and developments it treats are: fog filters, reverse flow filters, venturi scrubbers and multiple miniature cyclones. The book is the ideal source of information for anyone concerned with the industrial environment. Typical of its practical value are the drawings and detailed specification for hoods serving a wide variety of industrial situations. And it demonstrates the use of data and design principles with an example of how to design a system $6.00

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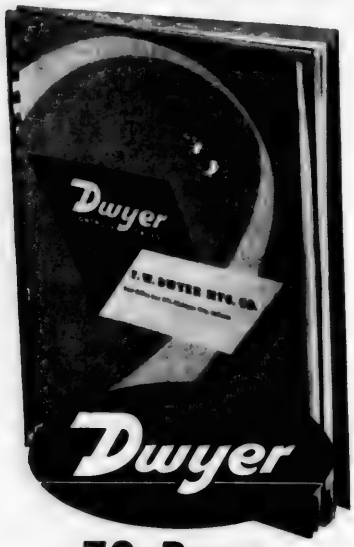

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(Continued from page 140)

ARD AIR CONDITIONING DIVISION, New York City, was announced. . .

Herbert G. Stephan is appointed director of national service for AIRTEMP DIV., CHRYSLER CORP., Detroit, Mich. David M. Lile will succeed him as manager of field operations and service parts . . .

Sales forces of FORGE & FITTINGS DIVISION, H. K. PORTER COMPANY, INC., Roselle, N. J., have been consolidated for better service to customers. James H. Wyres is named general sales manager of the Division, heading the sales activities of W-S Fittings Works (forged steel pipe fittings) and Cleveland Works (custom forgings and truck hardware). To assist him, James E. Ocello, formerly eastern sales manager, has been appointed manager of distributor sales; T. Bruce Cox, a sales engineer, was named manager of new product sales; former manager of catalog sales; E. H. Kyle has become manager of Industrial and truck hardware sales; and W. H. Dresing was appointed manager of commercial forging sales . . .

Harry E. Seim, vice president in charge of WESTINGHOUSE ELECTRIC CORPORATION'S STURTEVANT DIVISION, Hyde Park, Mass., has retired after fifty years of service. He was elected in 1948 as head of the division which specializes in air-handling products, heating-ventilating equipment, and Precipitron electrostatic air cleaners. Born in Brooklyn, N. Y., Mr. Seim at the age of 14 took his first job in 1909 with Bryant Electric Company, a Westinghouse subsidiary, Bridgeport, Conn. as office boy. Exactly twenty-five years later, he was elected Bryant's vice president . . .

At a recent directors meeting of W. D. ALLEN MFG. CO., Chicago, Ill., the following officers of the company were promoted:

H. E. Meng, formerly chairman of the board, to honorary chairman; E. H. Nelson, president, to chairman of the board; A. D. Symonds, executive vice-president, to president; W. F. Symonds, vice-president of manufacturing, to executive vice-president and secretary . . .

Adolph R. Schaub has been named manufacturing manager of L. J. WING MFG. CO., Linden, N. J., a division of Aero Supply Mfg. Co., Inc. Mr. Schaub comes from M. W. Kellogg Company, which he joined in 1939. There he served in project engineering, purchasing, and production management capacities. Most recently he was production manager and shop superintendent for Kellogg at Jersey City, N. J. . . .

DUNHAM-BUSH, INC., West Hartford, Conn., has appointed Joseph Jacobs, Jr., advertising manager. He will direct all phases of advertising and sales promotion for the concern's line of air conditioning, refrigeration, heating, and heat transfer products. Also announced is the appointment of John L. Roth. He was named product manager, air conditioning . . .

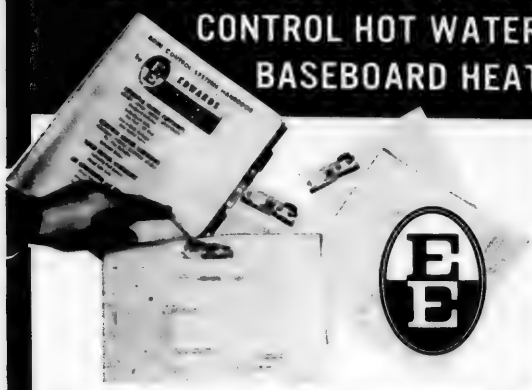
Wesley A. Songer is elected president and chief administrative officer of CRANE CO., Chicago, Ill. He had been executive vice-president . . .

COMBUSTION ENGINEERING, INC., New York, N. Y., elected Herbert M. Lowenstein and John L. Menson vice-presidents. Mr. Lowenstein is the former director of engineering product design, and is now vice-president and chief engineer. He joined the company in 1924 after proir service as an engineer officer with the Navy and as field engineer for the Bureau of Yards and Docks. He is a member of ASME and Verein Deutscher Ingenieure. Mr. Menson, formerly director of engineering field operations, is now vice-president-engineering. He has served as chairman of the American delegations to several meetings of ISO, both here and abroad . . .

The board of directors of WARREN WEBSTER & CO., INC., Camden, N. J., announced the appointment of Robert W. Butler as vice-president of operations. He has served in executive capacities with Crown Cork and Seal Company and Scovill Mfg. Co. . . .

(Concluded on page 144)

FREE! 70-PAGE HEATING & COOLING DESIGN HANDBOOK FEATURING LOW COST, ZONE CONTROL HOT WATER BASEBOARD HEAT



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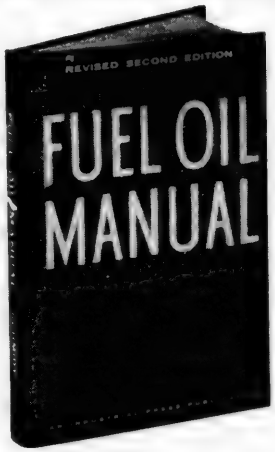

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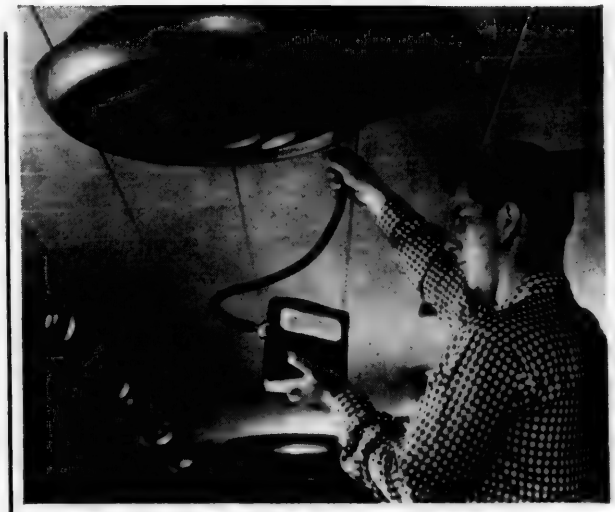

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Briefly Stated (Concluded)

W. E. Landmesser, a veteran of 20 years with the company, is named general sales manager for packaged products for YORK DIV., BORG-WARNER CORP., York, Pa. He succeeds R. E. Cassatt, who resigned to become vice-president of Regina Corp., Rahway, N. J. a realignment of responsibility within the company's Engineered Machinery Sales Department resulted in the promotion of F. C. Wood to manager, air conditioning sales. A more vertical alignment of responsibility will permit the sales managers to concentrate more closely on the equipment and markets under their supervision. Also announced was the naming of Albert J. Krause as merchandise manager, commercial air conditioning.

Several appointments were announced by THE TRANE CO., La Crosse, Wis. William E. Scollard was named Manager, Branch Plants, to administer operations of branches in Scranton, Pa., Clarksville, Tenn., and the new proposed plant at Salt Lake City, Utah. Sam H. Harper, Jr., has joined the company's San Antonio sales office as a sales engineer. Joseph G. Skach joined the St. Paul, Minn., office. Alvin L. Balzer is a new sales engineer in the San Francisco office. . .

Three executive appointments for the PERMAGLAS DIVISION of A. O. SMITH CORP., Kankakee, Ill., were announced. Walter M. Harris, named controller, was formerly manager, systems and procedures, for A. O. Smith in Milwaukee. Robert M. Timmerman is appointed manager of materials for the division and Howard D. Thomas is its manager of industrial relations. Appointments were effective December first. . .

Wayne D. Harman, formerly sales engineer in the Dallas branch of YORK DIVISION OF BORG-WARNER CORPORATION, has been named Dallas district manager for engineered machinery products of the firm. The appointment is a part of the company's expanded sales program which will place increased responsibility and authority in the hands of both district and regional managers.

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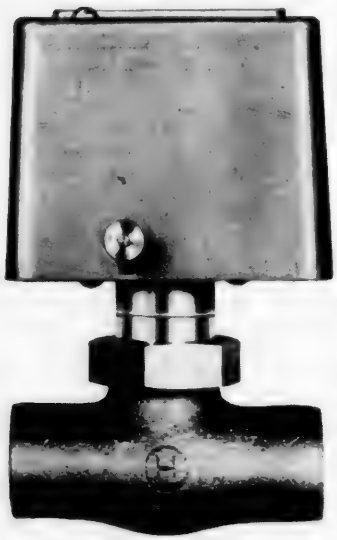

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Globe-type construction insures complete closure, positive heat control.

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Raises and lowers valve stem with silent power.

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Teflon surface of valve stem provides a permanent, self-lubricating seal.

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Gradual opening and closing cycles prevent noise in line.

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Compact body makes installation easy, even in tight places.

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Manual Operator conveniently located on outside of cover, always accessible.

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OBITUARIES

Harry R. Clarage, 70, President of Clarage Fan Company, Kalamazoo, Mich., died of a cerebral hemmorhage suddenly on December 26. Since 1945 he had been president of the company. Earlier he had served as a salesman in the New York and Detroit Offices and then as chairman of the firm's board of directors.

The company's history dates back to 1872 when Thomas Clarage, the grandfather, founded it as the Bird and Clarage Foundry. Later the firm became known as Thomas Clarage and Sons which manufactured steam engines, rollers for flour mills, parts for fanning mills used to clean grain, generators for lighting plants, and similar equipment. Mr. Clarage's father, Charles C. Clarage, pioneered the company's development in 1913 as a manufacturer of fans.

HIGH VELOCITY AIR FILTER PANELS

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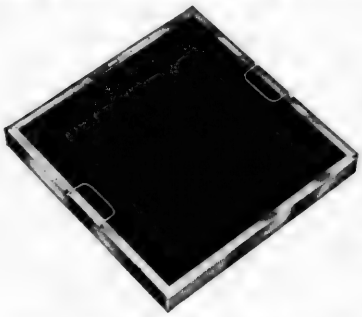

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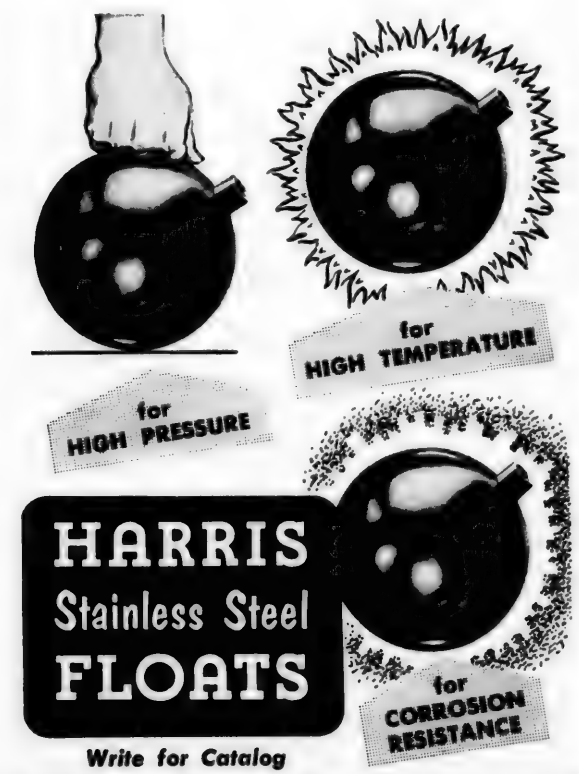

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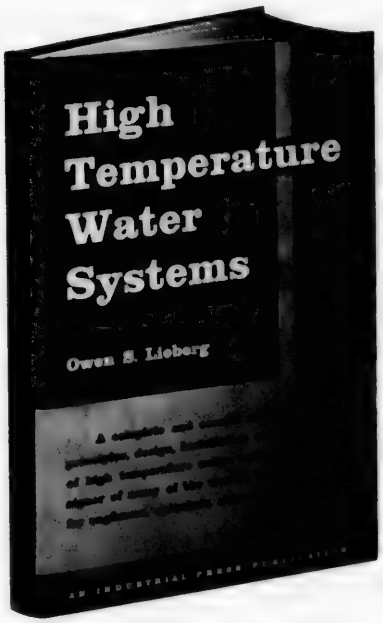

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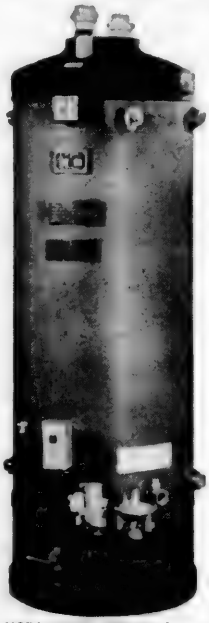

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BOOK REVIEWS

Publications abstracted in this department should be ordered direct from publisher.

DUCT CONSTRUCTION MANUAL

The Sheet Metal and Air Conditioning Contractors' National Association has prepared a manual of duct construction for ventilating and air conditioning systems. A subtitle indicates that its contents deal only with low velocity systems, that is, systems whose maximum static pressure does not exceed 2 inches of water column.

As stated in its foreword, the manual presents information necessary to design, fabricate, and install ductwork and related sheet metal construction, but avoids the engineering aspects of duct systems, such as static pressures, velocities, or equipment selection.

For the working engineer, here is an encyclopedia of detail sheets on ducts, hangers, elbows, branches, tees, register and grille connections, dampers of all sorts, access doors, fire doors, hoods of many kinds, equipment housings, supply and exhaust connections, and breechings. Included also is a suggested specification for sheet metal work in ventilating and air conditioning systems.

The large, full-page plates are very legible, with both single-plane and isometric projections, as needed for clarity. Sufficient text accompanies each page to explain each drawing.

Duct Manual and Sheet Metal Construction for Ventilating and Air Conditioning Systems, three-hole punched in flexible, Fabrikoid cover, 8½ x 11 inches, 141 pages. Published by Sheet Metal and Air Conditioning Contractors' National Association, Inc., 107 Center St., Elgin, Ill. Price is $5.00, but the Association will refer all orders to its local chapter, if one exists in the area from which the order came, so that the chapter, if it desires, may give the engineer a complimentary copy.

• • •

WELDING GUIDES—A 20-page report, compiled by nuclear power experts, covers welding ferrous materials for nuclear power piping operations. It includes welding procedures, joint design, quality control, qualification of procedures, and inspection methods. Price, $1.50. Welding titanium piping and tubing by gas tungsten-arc process are covered in a 24-page report. This is the first national publication to give the complete story on titanium welding, covering not only the process but also the selection of electrode and filler metal. Price, $1.50. American Welding Society, 33 W. 39th St., New York 18, N. Y.

STATE AIR POLLUTION LAWS—A digest of state air pollution laws has been prepared by Samuel M. Rogers, program advisor, Air Pollution Engineering Program and Sidney Edelman, assistant chief, Public Health Division, Office of the General Counsel, U. S. Department of Health, Education and Welfare. It is anticipated that the digest will be revised and supplemented from time to time to keep it current with new legislation. In general, the digest for the various states presents, where possible, in-

formation on the administrative organization, the powers and duties of the control authority, rules and regulations and penalties. Some states have a complete control organization established with regulations as to procedures and definite penalties; others have more or less token control. For a copy of this 117-page digest (Public Health Service Publication No. 711), write to Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price, 75 cents.

SCREW THREAD STANDARDS FOR FEDERAL SERVICES—This is the second of a series of three books into which NBS Handbook H 28 is divided. It covers standards for pipe threads, including threads for special applications such as hose couplings. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price, 75 cents.

COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available

INDUSTRIAL VENTILATION CONFERENCE—The 9th Annual Industrial Ventilation Conference, co-sponsored by the Division of Occupational Health of the Michigan Department of Health, and the College of Engineering, Michigan State University, at the Kellogg Center for Continuing Education, Michigan State University, East Lansing, Mich. Write to the University for details ..... **FEBRUARY 15-18, 1960.**

LUBRICATION SYMPOSIUM—ASME Lubrication Symposium, at the Engineering Societies Building, New York, N. Y. Secretary, American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. ..... **MARCH 14-15, 1960.**

CORROSION ENGINEERS SHOW—Annual conference and corrosion show of the National Association of Corrosion Engineers, at the Dallas Memorial Auditorium, Dallas, Tex. Secretary of the Association, 1061 M & M Building, Houston 2, Tex. ..... **MARCH 14-18, 1960.**

FIRST NATIONAL ELECTRIC HOUSE HEATING EXPOSITION, sponsored by the National Electrical Manufacturers Association, at the Sherman Hotel, Chicago. R. D. Smith, secretary of the Association, 155 East 44th St., N. Y. 17, N. Y. .... **MARCH 21-23, 1960.**

AMERICAN POWER CONFERENCE—22nd annual American Power Conference, sponsored by Illinois Institute of Technology, in cooperation with many technical societies and educational institutions, at the Hotel Sherman, Chicago, Ill. R. A. Budenholzer, conference director, Mechanical Engineering Department of the Institute, 3300 Federal St., Chicago 16, Ill. ..... **MARCH 29-31, 1960.**

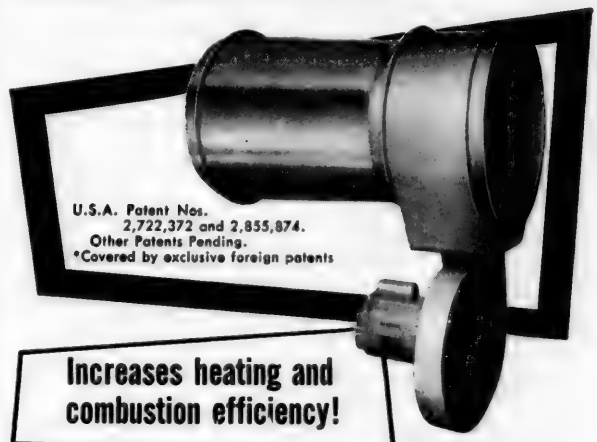
GAMA MEETING—Annual Meeting of the Gas Appliance Manufacturers Association, at The Greenbrier, White Sulphur Springs, West Va. H. Leigh Whitelaw, managing director of the Association, 60 E. 42nd St., New York, N. Y. ..... **MARCH 30-APRIL 1, 1960.**

NUCLEAR CONGRESS—Sixth Nuclear Congress, sponsored by the Engineers Joint Council and the Instrument Society of America, to be held in New York City. Headquarters to be announced later. Director of Technical and Educational Services, ISA, 313 Sixth Ave., Pittsburgh 22, Pa. ..... **APRIL 3-8, 1960.**

OHI EXPOSITION AND CONVENTION—23rd National Oil Heat and Air Conditioning Exposition, at the New York Coliseum, held concurrently with the 28th annual convention of OHI, at the Park-Sheraton Hotel, New York City. Secretary, Oil Heat Institute of America, Inc., 500 Fifth Ave., New York 36, N. Y. ..... **APRIL 4-7, 1960.**

(Continued on page 148)

Quickdraft... THE WORLD'S SAFEST POWER DRAFT UNIT FOR INDUSTRIAL, RESIDENTIAL AND INSTITUTIONAL EXHAUSTING



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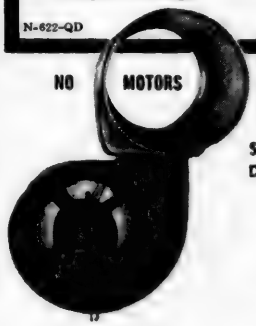

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(Continued from page 147)

BRI SPRING CONFERENCES—Building Research Institute Spring Conferences at Statler Hilton Hotel, New York, N. Y. Harold Horowitz, Assistant Director for Technical Programs, Building Research Institute, 2101 Constitution Ave., Washington 25, D. C. ..... **APRIL 19-21, 1960.**

CSA MEETING—Spring meeting of Central Supply Association, at the Palmer House, Chicago. J. H. Peery, secretary of the Association, 221 N. LaSalle St. Chicago 1, Ill. ..... **APRIL 20-22, 1960.**

ASME-SAM CONFERENCE—ASME-SAM Management Conference, at the Statler Hilton Hotel, New York, N. Y. Secretary, American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. ..... **APRIL 21-22, 1960.**

WELDING SOCIETY MEETING—41st Annual Meeting and Welding Exposition of the American Welding Society in Los Angeles, Calif. Headquarters to be announced later. A. L. Phillips, secretary of the Society, 33 W. 39th St., New York 18, N. Y. ..... **APRIL 25-29, 1960.**

WESTERN EXPOSITION—Third Western Air Conditioning, Heating, Ventilating and Refrigeration Exhibit and Conference, at Shrine Exposition Hall, Los Angeles, Calif. F. J. Tabery, exhibit manager, 3443 S. Hill St., Los Angeles 7, Calif. Exhibit sponsored by Western Air Conditioning Industries Association. ..... **APRIL 27-30, 1960.**

METAL EXPOSITION & CONGRESS—2nd Southwestern Metal Exposition & Congress, at State Fair Park, Automobile Building, Dallas, Tex. C. L. Wells, exposition manager, American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. .... **MAY 9-13, 1960.**

ISA CONFERENCE AND EXHIBIT—ISA Instrument-Automation Conference and Exhibit, at Brooks Hall, San Francisco, Calif. W. H. Kushnick, executive director of the Instrument Society of America, 313 Sixth Ave., Pittsburgh 22, Pa. ..... **MAY 9-13, 1960.**

DESIGN ENGINEERING SHOW—ASME Design Engineering Conference and Show, at the Statler Hilton Hotel, New York, N. Y. Secretary, American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. ..... **MAY 23-26, 1960.**

SAE MEETING—Summer meeting of the Society of Automotive Engineers, at the Edgewater Beach Hotel, Chicago, Ill. Secretary of the Society, 29 W. 39th St., New York, N. Y. ... **JUNE 5-10, 1960.**

I-B-R MEETING—Annual meeting of The Institute of Boiler and Radiator Manufacturers, at the Seaview Country Club, Absecon, N. J. Secretary of the Institute, 60 E. 42nd St., New York, N. Y. ..... **WEEK OF JUNE 6, 1960.**

NDHA MEETING—Annual meeting of the National District Heating Association, at Grove Park Inn, Asheville, N. C. Secretary of the Association, 827 N. Euclid Ave., Pittsburgh 6, Pa. ..... **JUNE 6-9, 1960.**

ASHRAE MEETING—Annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., at Royal York Hotel, Vancouver, B. C., Canada. Secretary of the Society, 62 Worth St., New York 13, N. Y. ..... **JUNE 13-15, 1960.**

ASTM MEETING—Annual meeting of the American Society for Testing Materials, at the Chalfonte-Haddon Hall, Atlantic City, N. J. Secretary of the Society, 1916 Race St., Philadelphia 3, Pa. ..... **JUNE 26-JULY 1, 1960.**

CONGRESS ON OCCUPATIONAL HEALTH—13th International Congress on Occupational Health, at the Waldorf Astoria Hotel, New York City. James W. Muckell, executive secretary, Room 415, 527 Madison Ave., New York 22, N. Y. ..... **JULY 25-29, 1960.**

(Concluded on page 150)

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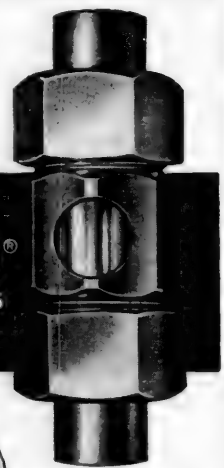

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(Concluded from page 148)

CRYOGENIC ENGINEERING CONFERENCE—1960 Cryogenic Engineering Conference, sponsored by the University of Colorado and the National Bureau of Standards, at the University of Colorado, Boulder, Colo. K. D. Timmerhaus, secretary, Chemical Engineering Department of the University, Boulder, Colo. **AUGUST 23-25, 1960.**

ISA EXHIBIT AND MEETING—ISA Instrument-Automation Conference and Exhibit, in conjunction with the 15th annual meeting, at the Coliseum, New York, N. Y. W. H. Kushnick, executive director, Instrument Society of America, 313 Sixth Ave., Pittsburgh 22, Pa. ..... **SEPTEMBER 26-30, 1960.**

CSA MEETING—66th annual meeting of Central Supply Association, at the Palmer House, Chicago. J. H. Peery, secretary of the Association, 221 N. LaSalle St., Chicago 1, Ill. **OCTOBER 5-7, 1960.**

Canadian Degree-Days for December, 1959*

City	December		Cumulative	
	1959	Normal	1959	Normal
Calgary, Alta.	1106	1430	3652	3660
Charlottetown, P. E. I. ..	1138	1210	2703	2850
Crescent Valley, B. C. ..	1220	1220	3486	3220
Edmonton, Alta.	1200	1660	3817	4070
Fort William, Ont.	1359	1680	3851	3960
Grande Prairie, Alta. ..	1240	1750	4019	4300
Halifax, N. S.	999	1109	2261	2513
London, Ont.	1096	1200	2654	2680
Medicine Hat, Alta.	1076	1440	3378	3410
Moncton, N. B.	1227	1340	2891	3100
Montreal, P. Q.	1293	1390	2944	3040
North Bay, Ont.	1447	1550	3692	3620
Ottawa, Ont.	1348	1460	3158	3210
Penticton, B. C.	977	1050	2749	2590
Prince George, B. C.	1163	1440	3734	3760
Quebec City, P. Q.	1416	1530	3418	3460
Regina, Sask.	1398	1740	4152	4150
St. John, N. B.	1161	1300	2834	3130
Saskatoon, Sask.	1367	1790	4131	4250
Timmins, Ont. ...	1634	1740	4323	4200
Toronto, Ont. ...	1034	1126	2438	2522
Vancouver, B. C.	771	810	2174	2120
Victoria, B. C. ...	723	730	2149	1970
Windsor, Ont.	987	1130	2377	2440
Winnipeg, Man.	1405	1778	4078	4030

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We need many additional agents all over this country to sell a most successful wet dust collector, manufactured and sold in 12 countries besides the U. S. A. We have been in business for 15 years and have the product and the reputation on which to expand our business. Only qualified ventilating engineers need reply. Our Agents have been notified of this advertisement. Please reply Box 959, Air Conditioning, Heating & Ventilating, 93 Worth St., New York 13, N. Y.

MANUFACTURERS' AGENTS

An established manufacturer with 25 years experience producing ventilating equipment is looking for manufacturer's agents in many sections of the country to sell their new line of industrial fans. The products include axial flow and tubeaxial fans, both direct and belt driven, and power roof ventilators.
Please reply Box 914, Air Conditioning, Heating & Ventilating, 93 Worth St., New York 13, N. Y.

If you are a responsible go-getter and looking for a line of plastic pipe produced by a reputable company, look no further, contact Sales Manager, Plastic Pipe Department, St. Regis Paper Company, Panelyte Division, RFD #3, Old 40 East, Richmond, Indiana.

DISTRICT SALES MANAGERS NEEDED FOR EXPANDING SALES PROGRAM

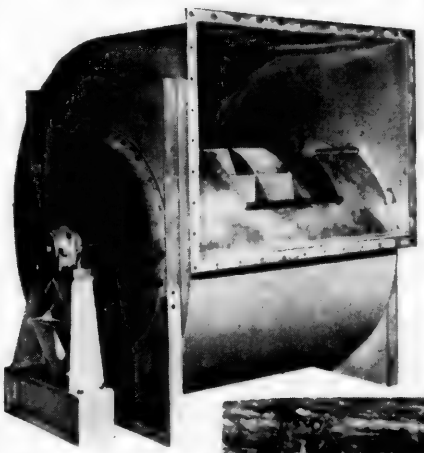
PETRO, leader in commercial-industrial oil and gas burners since 1903, has several immediate openings for District Sales Managers in various areas. Will call on Consulting Engineers, Architects, Dealers and Distributors. Must have M.E. degree or equivalent experience selling industrial firing or boiler room equipment. Training, with salary paid, will be given at our plant. Salary, bonus, expenses and other benefits. Age about 28 through 45. Send resume and full information to J. R. Crews, Sales Manager, PETRO, 3172 W. 106th St., Cleveland 11, Ohio.

WANTED EXPERIENCED EXECUTIVE

Capable of successfully operating SHEET METAL SHOP and CONTRACTING BUSINESS. Location —N. Y. Metropolitan Area. Excellent opportunity. Reply stating all pertinent information. Box No. 961, Air Conditioning, Heating & Ventilating, 93 Worth St., New York 13, N. Y.

PRINTED FORMS available for immediate shipment. Heating & oil burner materials form, burner service record cards, service order forms, inspection information form, survey sheet and others. Also can supply BURNER SERVICE form in 8 part EZE-SNAP with 3 carbons in each set, 1200 sets. Imprinted with your name, address and telephone, only $20.40. Send for samples—no obligation. Write Dept. AC, Degree Day Systems, 39-30 58th St., Woodside 77, N. Y.

In Pittsburgh's new Fort Pitt Tunnel, Bayley fans were chosen for ventilation



Here is the Bayley Type AP Series 4 Fan

Bayley fans were chosen for placement at both ends of the new Fort Pitt Tunnel.

Why Bayley? The engineers might have considered the 35 years of trouble-free service delivered by Bayley fans in the Liberty Tunnel in Allegheny County.

There are ten Bayley Type AP Series 4 fans to be installed in the Fort Pitt Tunnel.

Here is the new Fort Pitt Tunnel

Four Bayley Type AP Series 4, DW-DI, 108¾" wheel diameter fans to be installed at each end of the tunnel.

ONE END: Four fans—326,600 CFM, each at 3.0" S.P., 294 RPM, Motors 200 HP, chain drive.

OTHER END: Four fans—264,500 CFM, each at 1.99" S.P., 239 RPM, Motors 100 HP, chain drive.

ONE TUNNEL EXHAUST FAN AT EACH END on Emergency Standby—DW-DI, 98¼" wheel diameter, 300,000 CFM, each at 1.5" S.P., 320 RPM, Motors 150 HP, direct drive.

When you want a job well done, it's good sense to call Green.

Green-Bayley BLOWER DIVISION

THE GREEN FUEL ECONOMIZER CO., INC.

BEACON 3, NEW YORK

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*Advertiser appeared in preceding issue

HUGHES PRINTING CO.
EAST STROUDSBURG, PA.

INQUIRY SERVICE FOR ADVERTISED PRODUCTS

Use this Digest to locate and refer to the advertisements in which you are particularly interested, then fill out and mail a prepaid multipurpose postcard, either of two that appear on the yellow page following, to request further information from manufacturers.

PLUMBING PRODUCTS ..... from Jay R. Smith provide everything, except piping and fixtures, that is required for a clean, sanitary, easy to maintain restroom. Information is offered.
Inside Front Cover — Item 200

SIMPLE TRAP ..... operating principle in Armstrong inverted bucket steam traps provides the efficiency, dependability and freedom from maintenance necessary for the most profitable use of steam. Steam trap book is offered.
Page 1 — Item 201

PACKED EXPANSION JOINTS ..... produced by Yarnall-Waring guarantee continuous service. GunPakt joints never need repacking, are rugged, dependable, all-steel units. Many in service over 25 years with only nominal maintenance and no major repairs. Bulletin is offered.
Page 2 — Item 202

SOUND CONTROL CURB ..... from Jenn-Air reduces sound power 90% for whisper-quiet, efficient power exhauster ventilation. Information is available.
Page 5 — Item 203

CONDENSATION PUMPS ..... manufactured by Hoffman are centrifugal type units which provide many advantages and quality construction features. Information on company's pumps is available.
Page 7 — Item 204

SMOOTH-FIN COILS ..... permit ample heat exchange capacity in limited space. They were used in Wayne County General Hospital and Health Center, Eloise, Mich. Information is available from Aerofin Corp.
Page 9 — Item 205

FANS AND VENTILATORS ..... manufactured by Ilg eliminate vibration and cut down noise, too. Reason is careful dynamic balancing of all component parts. Four catalogs are offered.
Pages 11-13 — Item 206

SAFETY RELIEF VALVE ..... line, manufactured by McDonnell & Miller, is rounded out with the addition of a new and finer 2-inch valve. Entire rated capacity is obtained without diaphragms or other auxiliary lifting devices. Bulletin shows why.
Page 15 — Item 207

ONE-SOURCE RESPONSIBILITY ..... for air conditioning, heating and ventilating equipment that is designed, engineered and manufactured to a uniform standard of quality and performance is provided by Air-Lift, a new concept from American-Standard Industrial Division. Information is available.
Insert 17-20 — Item 208

STANDARD COILS-CUSTOM COILS ... to meet any requirement and any design load are available from McQuay, Inc. They can be made of any required or desired metal or combination of metals. Information is offered.
Page 21 — Item 209

GAS COOLING SYSTEMS ..... are being used by more and more businesses in the Chicago area. 275 gas air conditioning units from Arkla-Servel were installed in a one-year period. Information is available.
Pages 22-23 — Item 210

CAPACITOR-START MOTORS ..... from Wagner Electric Corp. pack more power into less space, give long, trouble-free service, and are easy to hook up. Bulletin is offered.
Page 24 — Item 211

PACKAGED UNITS ..... from York Corp. permit more competitive bidding. No other air conditioner offers so many important savings both now and later. Information is available.
Page 25 — Item 212

VENTILATORS FIT ..... like a glove when there's a self-flashing extruded aluminum Sonotrol curb, manufactured by Penn Ventilator Co., on the job. Bulletin is available.
Page 26 — Item 213

TURBINE TYPE PUMPS ..... from Aurora Pump Div. provide maximum efficiency, longer service life and easier maintenance. They will not vapor bind, and have a wide operating range. Literature is available.
Page 27 — Item 214

PIPELINE INSULATION ..... from Johns-Manville brings the traditionally fine appearance and performance excellence of power plant work to general commercial and industrial installations. Brochure is offered.
Pages 28-29 — Item 215

TWO HEATING PUMP BULLETINS .... are offered by Skidmore Corp., describing its redesigned duplex and single unit vertical type pumps and economy HS pump. One of these must be just right for your application. Complete engineering data is also available.
Page 30 — Item 216

OPEN-TYPE MOTOR ..... started even though embedded in ice. Research and testing of this type has established Allis-Chalmers as a pioneer-leader in the motor industry. Information is available.
Page 31 — Item 217

AIR DIFFUSING TROFFERS ..... from Barber-Colman have patented double-wall construction which isolates air from light for controlled air distribution, freedom from smudging, and maximum lighting efficiency. Catalog is offered.
Pages 32-33 — Item 218

Ad-Digest

INQUIRY SERVICE FOR ADVERTISED PRODUCTS

Use this Digest to locate and refer to the advertisements in which you are particularly interested, then fill out and mail a prepaid multipurpose postcard, either of two that appear on the yellow page following, to request further information from manufacturers.

VACUUM BREAKERS ..... made by Sloan Valve Co. incorporate double protection to prevent back-syphonage. You pay no more for this added bonus of quality. Information is available.
Page 34 Item 219

AIR CONDITIONING CABINETS ..... from Buffalo Forge Co. are completely-packaged, high pressure units designed for high humidity installations such as hospital operating rooms and laboratories. Bulletin is offered.
Page 35 Item 220

INDUSTRIAL AIR FILTER ..... from Research Products Corp. gives you more, costs you less, and provides many features for heating or air conditioning. Information is available.
Page 36 Item 221

EXHAUST SYSTEMS ..... function better and workers are more efficient and comfortable with Wing fresh air supply heaters. Literature is offered.
Page 37 Item 222

CAST IRON BOILERS ..... shown in ad were designed specifically to achieve the economies possible with horizontal rotary oil burners using low-cost heavy oils. Manufacturer, Weil-McLain Co., offers bulletin.
Page 38 Item 223

DRAFT CONTROL ..... is offered for commercial-industrial gas equipment, and is recommended by leading gas companies. The Field draft control boasts compact size, draft assistance, load flexibility and automatic control. Information is available.
Page 39 Item 224

STAINLESS STEEL DUCT FURNACES .. from Reznor are demanded by tough buyers because the heat exchanger and burners cannot corrode. Information is available.
Page 40 Item 225

PLUG TYPE BRONZE VALVES ..... are available from Jenkins Bros. Only this company gives you 18-point protection against valve repairs. Descriptive folder is offered.
Page 41 Item 226

CENTRIFUGAL PUMP ..... Application Manual from Buffalo Pumps is a 277-page fact filled handbook on centrifugal pumps and their application. Cost is five dollars. Ad contains order form.
Page 43 Item 227

PACKLESS RADIATOR VALVES ..... are but part of the extensive line of heating specialties offered by Marsh Instrument Co. Other products include traps, gages, and thermometers. Catalog is available.
Page 44 Item 228

COPPER TUBING ..... from Kensico is relied on by control engineers to help solve problems related to instrumentation and control systems. Information and flow charts are offered.
Page 45 Item 229

BLOWER CONDENSER ..... from Dunham-Bush offers high performance and exceptional installation flexibility due to its low silhouette shape. It can be installed anywhere on any roof without costly reinforcement of roof members. Literature is available.
Page 46 Item 230

EXPANSION JOINTS ..... in packless, packed, and slip type models are available from Adsco Div. Company's representatives handle piping problems, too. Comprehensive catalogs are offered.
Page 47 Item 231

CONVECTORS ..... manufactured by Young Radiator Co., in both sloping-top free-standing and partially-recessed types, were selected to efficiently heat the Winter Olympic Games dormitories at Squaw Valley, Calif. Catalog is offered.
Page 48 Item 232

COPPER TUBE AND FITTINGS ..... assemblies from American Brass Co. are compact, and result in greater ceiling height and more usable floor area. Wide plumbing walls are not required. Information is available.
Page 49 Item 233

EXTRUDED ALUMINUM GRILLES ..... for floors, sills and walls are manufactured by Waterloo Register Co. They fit perfectly into modern architectural and engineering concepts. Selection guide is offered.
Page 50 Item 234

PACKAGED LIQUID COOLER ..... from Bell & Gossett was part of the 100% remodeling of The State Exchange Bank, Culver, Ind. The cooler is called completely new in conception; it is competitive in price. Information is offered.
Page 51 Item 235

ALUMINUM FIN STOCK ..... from Scovill Mfg. Co. can help fabricators speed their operations and achieve superior heat transfer components. Information is available.
Insert 53 Item 236

COOLING AND HEATING ..... are both being furnished by Thermal multizone and central plant units to provide air conditioned comfort on the ground for air travelers at Daytona Beach Airport, Florida. Information is available.
Page 54 Item 237

PREFABRICATED PIPING SYSTEMS ... from Ric-wiL have been installed world wide. The year 1960 marks 50 years of service by the company. Information on these quality piping systems is available.
Insert 55 Item 238

FLEXIBLE UNITS ..... from Typhoon allowed engineers to design space saving air conditioning installations in new Jewel Food Supermarkets. Company offers a reference chart which shows broad equipment line.
Page 56 Item 239

The items appear in the same order as the advertisements to which they refer, to facilitate obtaining further information after reading an advertisement. All advertisements are digested here except those that are received too late for inclusion in this listing.

Ad-Digest

INQUIRY SERVICE FOR ADVERTISED PRODUCTS

ONE-PIECE INSULATION .....
from Gustin-Bacon is becoming increasingly popular for high velocity circular ducts for the same reasons that have made it the preferred pipe insulation. Information is available.
Page 57 Item 240

TRANSITE VENT PIPE .....
produced by Johns-Manville is made of asbestos-cement; retains its original, attractive appearance, and saves on upkeep because it resists the attack of most gases, mists, fumes, and dusts. Information is available.
Page 58 Item 241

INDUSTRY'S HEATING PROBLEMS ....
can be solved with the broad line of industrial units manufactured by Lennox Industries; includes unit heaters, duct heaters, and larger central units. Information is offered.
Page 59 Item 242

AIR HANDLERS .....
are manufactured by Halstead and Mitchell in 880 to 47,500 cfm range. They are sturdy, quiet and economical. Bulletin is offered.
Page 117 Item 243

BURNER RELIABILITY .....
was a paramount consideration for the 1960 winter Olympics site at Squaw Valley. Ray burners were specified and purchased. Catalog is available.
Page 119 Item 244

BACKWATER VALVES .....
from Josam Mfg. Co. stop backwater instantly. They permit constant drainage to sewer, yet prevent the entry of any backwater or sewage into basement. Manual is offered.
Page 121 Item 245

UNITARY AIR CONDITIONERS .....
have been rated by Air Conditioning and Refrigeration Institute. Seal of certification is public's guarantee that equipment meets its published standards of performance. Directory of participating manufacturers and explanatory booklet are offered.
Page 123 Item 246

HEAT EXCHANGERS .....
for radiation and water heating are offered by Bell & Gossett Co. They assure not only high efficiency but also highest quality construction. Three catalogs are offered.
Page 125 Item 247

MERCURY SWITCH EQUIPPED .....
Mercoid controls, for pressure, temperature, liquid level, and mechanical movement, are described in a new catalog which is available from the manufacturer.
Page 126 Item 248

DUAL FUEL BURNER .....
developed by Iron Fireman Mfg. Co. makes firebox boilers super-efficient. It conserves boiler heat, cuts costs, burns clean with no smoke, needs no stack, and is a complete package. Information is available.
Page 127 Item 249

COMBINATION VALVE .....
for tub and shower is offered by Symmons Engineering Co. It provides full flow and temperature control with only one moving part. Bulletin which is available gives all details.
Page 128 Item 250

FLOATLESS PUMP CONTROLLER .....
from Chicago Pump has every advantage of other floatless controllers, plus certain advantages of being sealed. Information is available.
Page 129 Item 251

LOW PRESSURE CONDENSATE PUMPS
from Sterling, Inc., are specially engineered, not just adaptations of industrial or water supply pumps. Complete information is available.
Page 130 Item 252

SLOT TYPE DIFFUSERS .....
from Air Devices, Inc., were installed in Administrative and Research Center, International Mineral & Chemical Corp., Skokie, Ill. Units provide unvaried distribution of noiseless, draftless conditioned air. Catalog is offered.
Page 131 Item 253

HIGH TEMPERATURE WATER .....
generators from International-LaMont have unequalled acceptance. More than 130 units already in operation have a total capacity exceeding three billion Btu per hr. Bulletins are available.
Page 132 Item 254

HIGH EFFICIENCY FILTER .....
from Cambridge Filter Corp. provides positive filtration, easy installation and maintenance. Aerosolve filter has lowest pressure drop of any positive high efficiency filter. Bulletin is offered.
Page 133 Item 255

ECONOMICAL CONDENSERS .....
from Niagara Blower Co. are lower in first cost and bring greater returns in power savings, water savings, and reduced maintenance expense. Two bulletins are offered.
Page 134 Item 256

FLEXIBLE HOSE .....
from The Flexaust Co. is adaptable for all kinds of fume and dust control and ventilation uses. It is durable, lightweight, and easy to install. Details are available.
Page 134 Item 257

SUBMERSIBLE PUMPS .....
including sewage pumps and sump pumps are available from Weil Pump Co. They are economical, quiet operating units that are factory assembled, ready to run. Information is offered.
Page 135 Item 258

BURNER NOZZLE .....
on both oil-fired and gas-fired packaged boilers from Cleaver-Brooks can be pulled and replaced in forty seconds. Additional information is available.
Page 136 Item 259

Ad-Digest

INQUIRY SERVICE FOR ADVERTISED PRODUCTS

Use this Digest to locate and refer to the advertisements in which you are particularly interested, then fill out and mail a prepaid multipurpose postcard, either of two that appear on the yellow page following, to request further information from manufacturers.

LINE TAP VALVES ..... from Watsco, Inc., have inexpensive ports for charging, discharging and testing. Illustrated brochure is offered.
Page 137 Item 260

AXIAL ROOF VENTILATORS ..... by Western Engineering & Mfg. Co. are offered in two new models shown in ad: A low silhouette hooded exhaust unit and a low silhouette vertical exhaust ventilator. Information is available.
Page 137 Item 261

QUICK AND EASY DUCT TAPING ..... with Arno Ductape can be proven by free test sample offered. Seals ducts and secures insulation. Self-adhesive, vapor proof, waterproof, costs as little as ½c per ft. Flame resistant type available.
Page 137 Item 262

INDUSTRIAL THERMOMETER ..... is offered by Palmer Thermometers, Inc., with advantages including red-reading mercury, extruded brass case, and chrome finish. Bulletin is available.
Page 138 Item 263

ELECTRIC STEAM BOILERS ..... are manufactured by P. M. Lattner Mfg. Co. in ten sizes. Of ASME construction, the units have highly sensitive adjusting controls. Information is available.
Page 139 Item 264

ROOF FAN ..... designed for eye appeal, and engineered and built for top performance, is manufactured by Allen Cooler and Ventilator, Inc. Specifications and data are offered.
Page 139 Item 265

SPRAY NOZZLES ..... from Spraying Systems Co. lower the cost of conditioning air because the company designs them for exact control of spray characteristics and offers them in a complete range of sizes for selecting the exact capacity needed. Two bulletins give all the details.
Page 139 Item 266

HOT WATER HEATING PLANTS ..... from HydroTherm Inc. automatically adjust capacity to load, saving fuel dollars and installation cost. Catalog is offered.
Page 140 Item 267

INSTRUMENT MANUAL ..... is offered to all users of gages and controls by F. W. Dwyer Mfg. Co. 72-page manual includes engineering data.
Page 142 Item 268

DESIGN HANDBOOK ..... available from Edwards Engineering Corp. covers heating and cooling, and features application of low cost, zone controlled hot water baseboard heat.
Page 143 Item 269

AIR FLOW SYSTEM ..... can be balanced once and for all times with the Alnor Velometer. There are no call backs to correct hot or cold spots. Bulletin is offered.
Page 143 Item 270

FOR ZONE HEATING ..... on steam and hot water systems, only Zonvalve, by Heat-Timer Corp., has 7 important features listed in ad. Brochure is offered.
Page 144 Item 271

STAINLESS STEEL FLOATS ..... from Arthur Harris & Co. are offered for high pressure, high temperature and corrosion resistant applications. Catalog is available.
Page 145 Item 272

HIGH VELOCITY FILTER PANELS ..... made by Air-Maze Corp. are all metal, permanent, washable panels for ventilating and air conditioning systems. Descriptive bulletin is offered.
Page 145 Item 273

LOW COST HOT WATER ..... is available with Ewing vertical heavy duty hot water heaters. Quality construction in every detail, neat and attractive design, with silent, automatic operation. No electrical hookup required. Information is available.
Page 146 Item 274

POWER DRAFT UNIT ..... for industrial, residential and institutional exhausting, is available from Quickdraft. It increases heating and combustion efficiency with no motors, fans or bearings in exhaust lines. Engineering data are offered.
Page 147 Item 275

STEAM AND HOT WATER ..... generators from Cyclotherm save costs, save time and save space. Boiler design does in two passes what other combustion methods accomplish in four. Information is available.
Page 148 Item 276

AIR FILTER GAGES ..... in three types are offered by Ellison Draft Gage Co., Inc. Bulletin describing the high precision instruments is available.
Page 150 Item 277

POSITIVE SEALING INDICATORS ..... made by Allin Mfg. Co. proven on thousands of production line installations have one piece extension gasket for positive sealing and fool-proof assembly. Six sizes. Complete line catalog available.
Page 150 Item 278

PRESSURE BURNERS ..... for dual-fuel, gas, or oil are offered by Synchronous Flame. Designed for hard-to-fire jobs: all types of boilers, warm air furnaces, and ovens. Many standard features which are extras on other burners. Detailed information offered.
Page 150 Item 279

VENTILATION FANS ..... at both ends of Pittsburgh's new Fort Pitt tunnel were Bayley Type AP Series 4 units. Information on company's fans is available.
Page 151 Item 280

AIR MOVING EQUIPMENT ..... from Clarage Fan Co. was selected for Texas' new Southland Center because of its record for performing quietly, economically, and dependably. Information is offered.
Inside Back Cover Item 281

AIR FLOW CONTROLLER ..... from Johnson Service Co. provides positive, constant volume air discharge through high velocity mixing units in dual duct systems. Bulletin is available.
Back Cover Item 282

CIRCLE FOR NEW EQUIPMENT AND LITERATURE INQUIRIES

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PLEASE PRINT CLEARLY

Name .....

Title or Job Function .....

Firm .....

Nature of Firm's Business .....

Street .....

City .....Zone ....State .....

TO ORDER BOOKS DESCRIBED BELOW

Please send and bill me for the books circled: February '60

A B C D E F G H I J K L M N O P Q R S T U V

FIRST CLASS
PERMIT NO. 53
NEW YORK, N. Y.

BUSINESS REPLY CARD
NO POSTAGE NECESSARY IF MAILED IN UNITED STATES

POSTAGE WILL BE PAID BY

AIR CONDITIONING, HEATING and VENTILATING
93 WORTH STREET
NEW YORK 13, N. Y.

READERS SERVICE DEPT.

This service is not available to overseas readers. Cards are void after May 1, 1960.

BOOKS TO HELP YOU WITH YOUR DESIGN PROBLEMS

DESIGN OF AIR CONDITIONING SYSTEMS
by F. W. Hutchinson

115 full-page charts solve problems of air conditioning system design involving cooling load, duct design, psychrometrics, solar energy, comfort conditioning, panel cooling, etc. For each chart the engineering and mathematical background plus design example and solution are given. **336 Pages, 118 Illus., $7.00.**

TO ORDER CIRCLE B ON CARD ABOVE

DESIGN OF HEATING AND VENTILATING SYSTEMS by F. W. Hutchinson

96 full-page charts solve problems of heating and ventilating involving load determination, duct design, panel heating, solar heating and combustion analysis. Companion book to Design of Air Conditioning Systems. Same methods to explain and solve problems are used. **320 Pages, 96 Charts, $7.00.**

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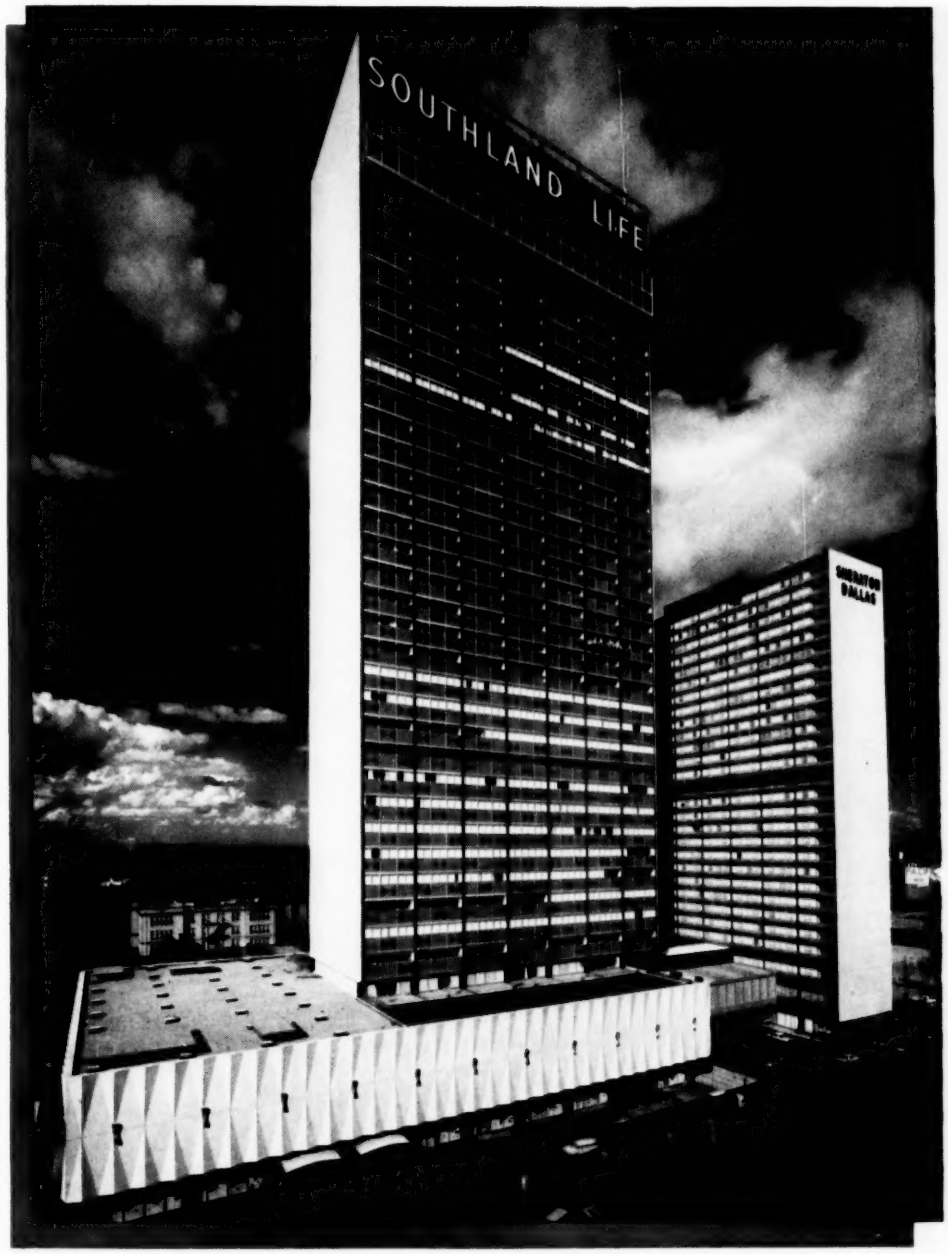

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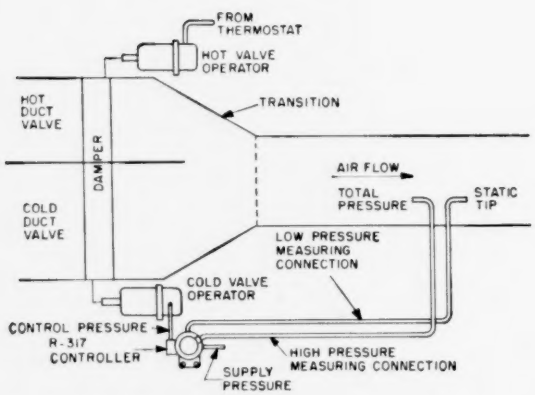

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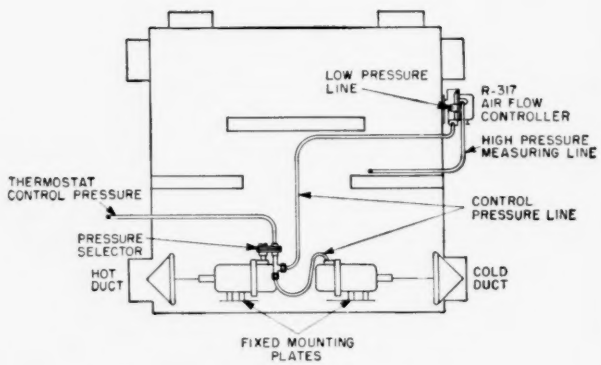

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